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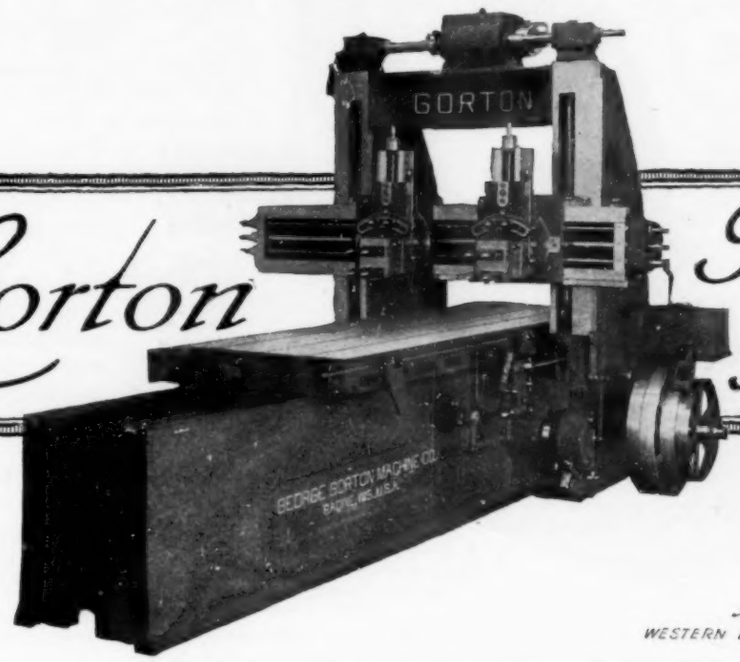


The Gorton Planing Machines

By J. V. Hunter,
WESTERN EDITOR, AMERICAN MACHINIST

This article introduces an entirely new line of machines for the company building them. These planing machines are intended to be the forerunners of a more extended line which will be developed as conditions warrant. Both the belt and the motor drive models are built in the sizes now listed. Years of experience in machine tool building have been incorporated in the various features of the design.

WHEN a firm that has had years of experience in building fine machine tools starts to build another line, they have the advantage of being able to draw on their past experience. This is true of the George Gorton Machine Co., Racine, Wis., which is now building planing machines for the market.

The first of the Gorton planing-machine line, illustrated in the headpiece, which is now presented to the buying public, is a size rated at 31, 37 or 42 in. between the housings with 31 in. under the crossrail. This is a heavy machine for its size with a sturdy construction throughout, designed to afford a maximum degree of rigidity. Thus the machine is planned to carry all loads within the capacity of the table and housing without danger of springing the table or bed.

The bed is of massive design with its walls extending to a solid floor line to obtain rigidity, and the maker does not suggest a foundation unless it is placed on a floor or soil that is soft and yielding. The bed is planed on the bottom surface, which aids in removing strains and is an advantage when shifting a machine on skids or when leveling up in its working position.

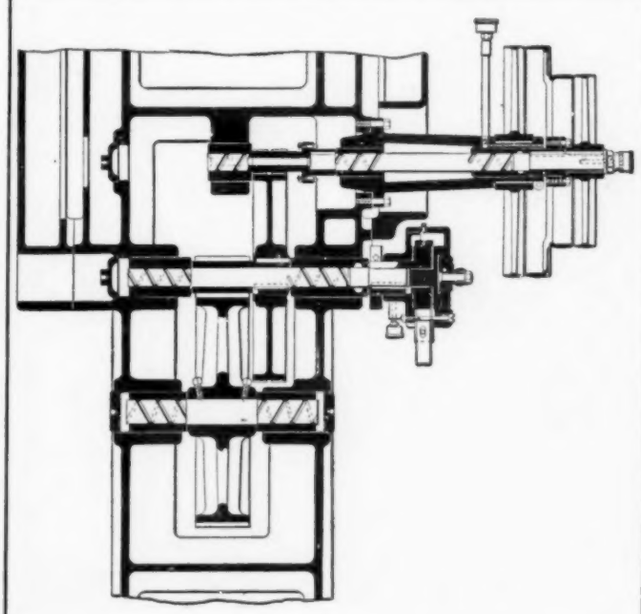


FIG. 2. DETAILS OF DRIVE MECHANISM AND GEAR CASE

The top of the bed is closed except for a section at the center where the gears are located. At this point it forms a completely walled and bottomed oil-tight case in which the gears run and is maintained partly filled with oil. Care has been exercised in making the pattern for the bed to obtain an even proportioning of the metal sections. The weight of the sections is gradually increased toward the center where the strains are greatest, and it is well ribbed for additional stiffness.

As may be seen from the sectional view of the drive gears, Fig. 2, the shaft-bearing hubs are all

cast solid with the bed and have amply long bearing surfaces. A large jig is used while boring and reaming these bearings, so that no hand fitting is required while placing the drive gears. The bearings themselves are all bushed in a manner that the bushings are supported almost their entire length.

It is intended that the oil-tight case in which the gears are located shall be kept filled with oil to the center of the shafts, and when filled to this point it holds 45 gal. As will be noted from the illustration, the ends of the shaft bearings are plugged with tight-fitting caps which prevent the escape of oil. The shafts are grooved spirally the length of the bearings. The oil from the dead end of each bearing can run back to the main chamber through a small drilled escape hole. The bearings on the friction end of the intermediate shaft and the outer end of the pulley shaft are packed with graphite packing in a collar-type packing gland which is a part of the bushing and prevents oil from being wasted at these points.

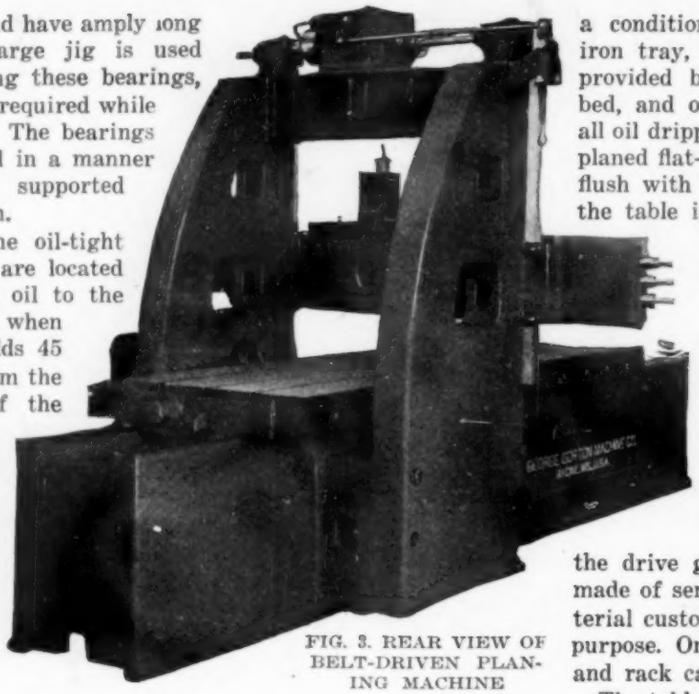


FIG. 3. REAR VIEW OF BELT-DRIVEN PLANING MACHINE

With this type of construction the gears are constantly working in an oil bath so the wear is reduced to a minimum. The bull gear carries a heavy surface of oil up on the face of the rack and from this the surplus is removed by suitable wipers and runs back into the main oil chamber. The probability exists that no wiper will remove all the surplus oil and some would remain to drip onto the floor when the travel of the table extends it beyond the bed. To take care of such a condition a special sliding cast-iron tray, or cover plate, has been provided between the ways of the bed, and of ample width to gather all oil drippings. This tray slides on planed flat-ways and its outer end is flush with the end of the bed when the table is not extended. This oil drip slide may be readily pulled forward by the machine operator to take care of the length of the travel of the table. This has drainage so that all oil collected returns to the main chamber through suitable screens which remove any stray chips.

On standard machines the drive gears and table rack are made of semi-steel, which is the material customarily employed for this purpose. On special order, steel gears and rack can be provided.

The table is thick and made in the box-section type with closed bottom so that the mechanism beneath is entirely sealed from danger of falling dirt or chips. The cored openings along the sides of the table are noticeable in the front view of the machine, Fig. 1, and in the rear view, Fig. 3. Through these openings may be readily removed any chips that may have fallen through the bolt holes in the table onto the solid bottom beneath. Since these chips are so easily removed and cannot endanger the driving mechanism, no provision need be made for closing the holes and they are always conveniently open. A heavy section of casting is provided surrounding the T-slots to avoid danger of a break-through from unusual strains.

In this connection it is interesting to mention the

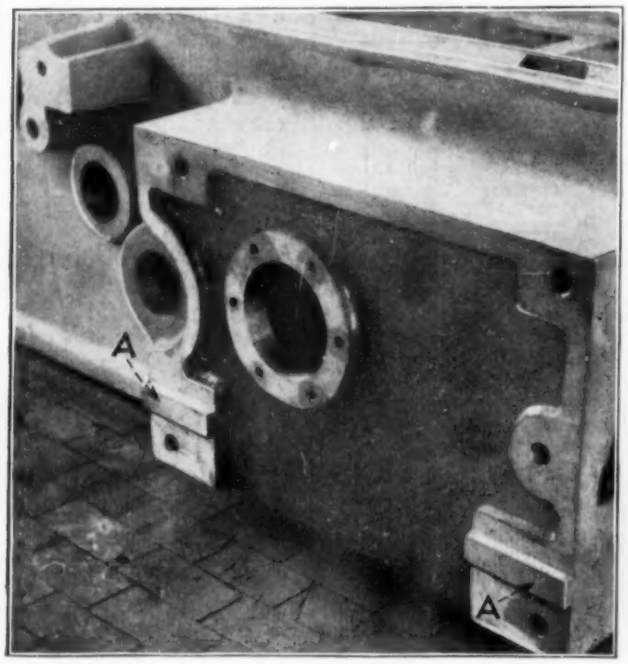


FIG. 4. BEARING FACE FOR HOUSING, SHOWING ALIGNMENT TONGUES

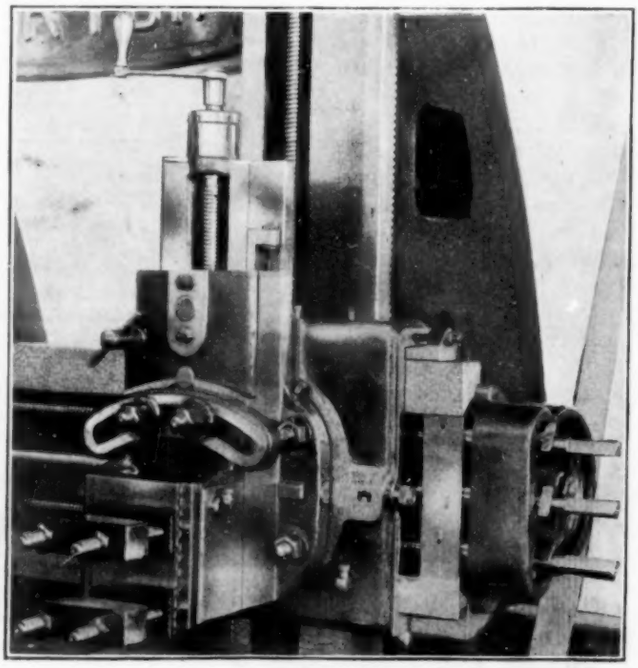


FIG. 5. TOOLHEAD AND CROSSRAIL, SHOWING FEED SCREWS

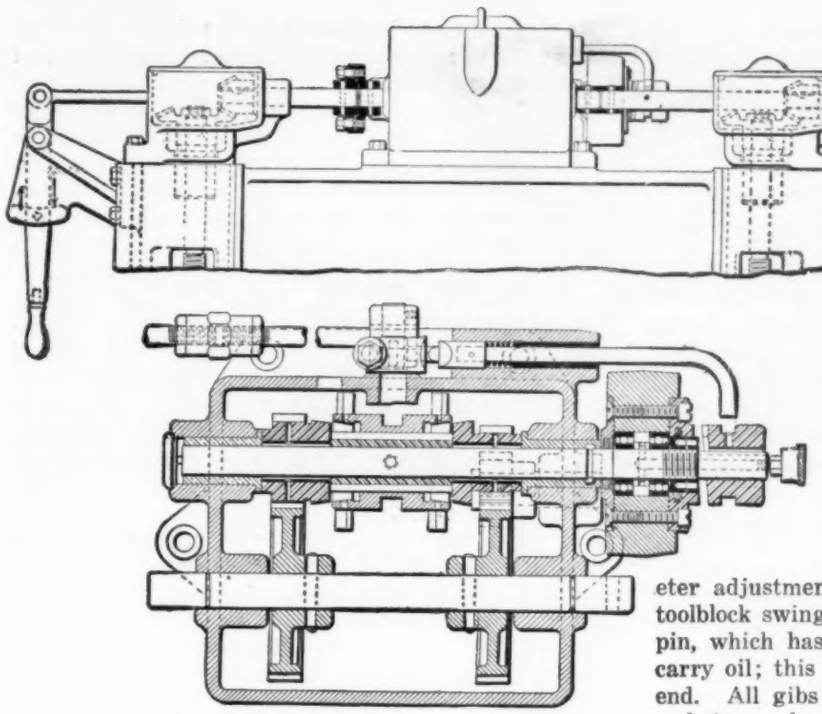


FIG. 6. DETAILS OF CROSSRAIL ELEVATING MECHANISM

special wrenches, furnished with the machine, which are used by the operator when putting bolts through the pin holes. These are bent and have a hexagonal socket for holding the nut so that the operator may readily handle these through the cored openings in the sides of the table.

The table of each planing machine is finished on its top, sides and T-slots, while on its own bed during the process of manufacture, which insures that these surfaces are parallel with the ways and crossrail. The ways of the table and bed are wide and heavy to afford bearing surface which shall sustain a minimum of wear. In the table ways are cut oil grooves suitable for conveying the lubricant to all portions of the bearing surface.

A massive box section has been employed for the form of the housings, with thick and uniformly proportioned walls. The bearing ways for the crossrail have wide faces and provide a firm support. The housings are held in alignment by tongues like *A*, Fig. 4, which fit grooves in the housings, and also by hardened and ground taper pins of large size. The housings are bolted to the bed by heavy capscrews.

The reader will note the full and substantial channeled arc of the housing yoke. The crossrail is wide with the lower way for the saddles dovetailed and the upper one square, as shown in Fig. 5.

The toolheads have a broad bearing surface upon which they swivel, and have a graduated dial so that they may be set at any determined angle. The screw which locks the slide to the swiveling member pulls the slide tightly against the swivel, making a firm joint.

The heads are made right and left and the left-hand head may be run out on the end of the rail giving the right-hand head full travel between the housings. The vertical feed screws on the toolblock slides are designed to be in tension at all times, and have micrometer adjustment collars reading in thousandths. The toolblock swings on a large hardened and ground taper pin, which has grooves milled on its outer surface to carry oil; this is supplied by a grease cup in its outer end. All gibs are of tapered form, being adjustable endwise, and are grooved to allow the oil to spread over the slides.

The bolts for clamping the tool are made from 3½-per cent. nickel steel and are heat-treated before finishing. Their threads are lathe cut to insure

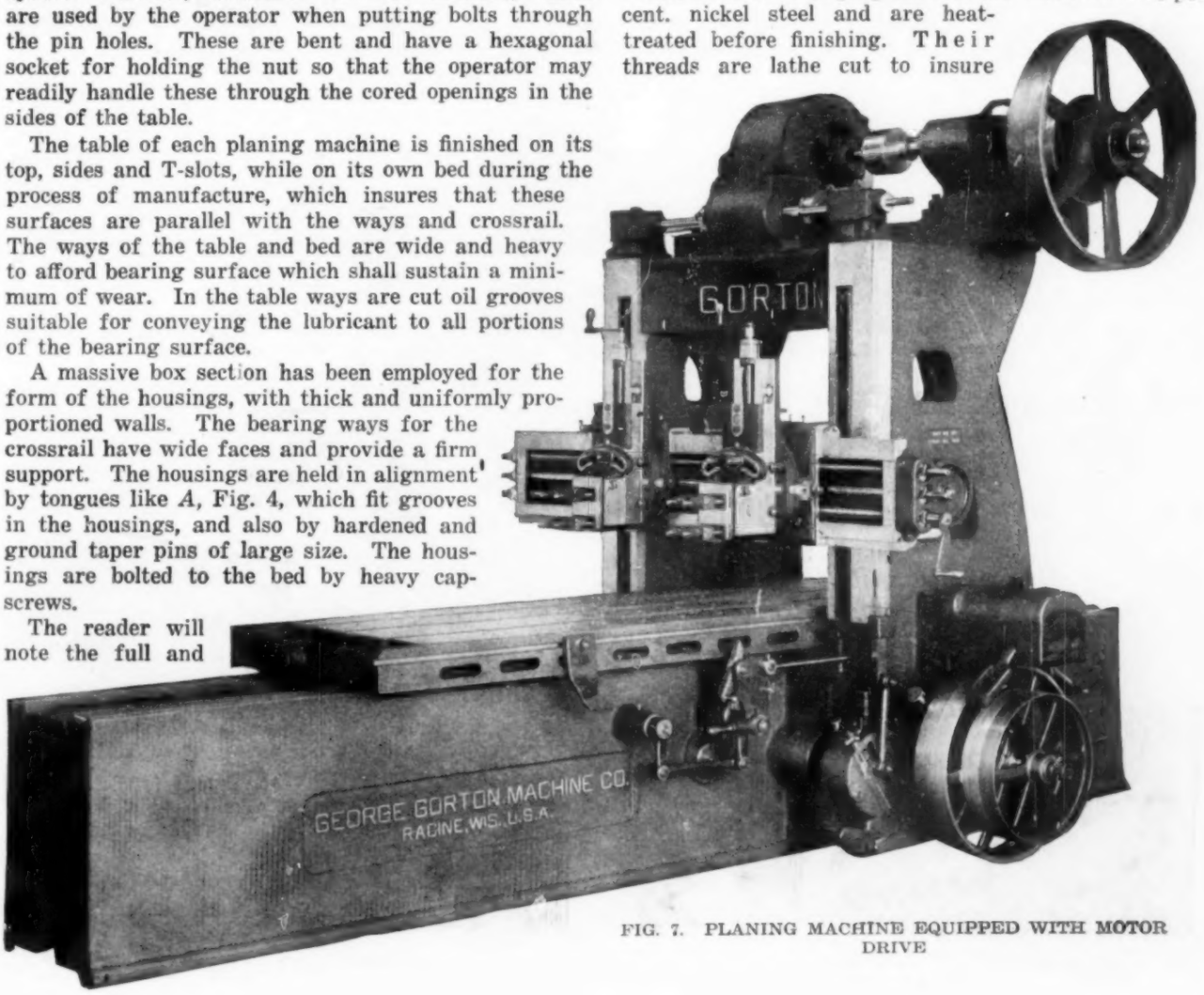


FIG. 7. PLANING MACHINE EQUIPPED WITH MOTOR DRIVE

greater accuracy. The saddle feeding mechanism is of the usual type. The crossrail is raised and lowered by a power feed device and the box containing the bronze bushed gears for this movement may be seen on top of the housing yoke. This substantially constructed box incloses all these gears so that they may be run in a bath of oil and be noiseless in operation. The details of the elevating gear-box design is clearly shown in the illustration, Fig. 6.

The Elevating Clutch

The clutch which controls this motion is operated by a lever on the left side of the machine, and bears suitable instructions to prevent the operator from throwing it in the wrong direction. The bevel gears which transmit this feed movement to the elevating screws are mounted on ball-thrust bearings, and are entirely inclosed and run in oil.

Aluminum Drive and Reverse Pulleys Used For Easy Operation

Aluminum drive and reverse pulleys are used in order to make their operation as easy as possible. They are securely clamped to steel hubs by means of setscrews and clamp studs, and the hub in turn is rigidly keyed to the shaft. High belt speeds are used and the table obtains quick reverse action which aids in increasing production. The large idler pulley is not mounted directly on the shaft, but has a bearing on the end of the large shaft bearing sleeve, which is bolted to the bed and projects out through the housing. This allows the driving pulley to be pressed on the shaft and eliminates the use of an outboard bearing, a feature that will meet general approval.

The table is prevented from starting accidentally by a safety plunger. It may be controlled from either side by means of levers connected to the belt-control cams. The belt-operating cams are cylindrical and engage hardened and ground conical rollers which are adjustable for wear.

Steel Bushed Belt Arms

The belt arms are provided with ground-steel bushings which are pressed in and work on ground-steel studs. The arms also have finished bearing surfaces close to the edge of the bracket which serves to take part of the weight off the studs and makes the arms easier to shift. The entire shifting mechanism is inclosed by a dirt excluding cover which keeps this mechanism free from dirt.

Two views are given showing a machine equipped with motor drive, Fig. 7 showing the front and Fig. 8, the rear view. A 10-hp. motor running at 1200 r.p.m. is used. This is solidly bolted to the heavy shelf resting on brackets cast solid with the housings. It is connected through a flexible coupling to the shaft of a $2\frac{5}{8}$-to-1 herringbone gear reduction. These gears run continually in oil and the latter circulates through the pulley bearing, making oiling unnecessary, other than to maintain the oil level in the box. The driving pulleys run on a heavy sleeve bolted to the box, and this takes the heavy bending strain off the driving shaft.

Specifications

Height planed, 31 in.; width planed, 31, 37 and 42 in.; shortest length of table between pockets, 6 ft.; proportion of bed to table length, $1\frac{1}{8}$ to 1; height, top of bed to floor, $31\frac{1}{2}$ in.; distance between center of V-ways, 16 in.; width of table, for 30 x 30, 26 in.; for 36 x 30, 32 in.; for 42 x 30, 35 in.; thickness of table, $4\frac{1}{2}$ in.; widths of T-slots, $1\frac{1}{16}$ in.; size of pin holes, $\frac{3}{4}$ in.; length of downfeed, 10 in.; size of tool in block, $2\frac{1}{4}$ x $2\frac{1}{4}$ in.; width of cutting belts, 2 in.; speed of countershaft, 450 r.p.m.; tight and loose pulley on countershaft, 16 x $4\frac{1}{4}$ in.; for motor-driven machines: size of motor, 10 hp.; speed of motor, 1200 r.p.m.; weight standard machines: for 30 x 30, 12,000 lb.; for 36 x 30, 13,300 lb.; for 42 x 30, 15,000 lb.; additional weight for each additional 2 ft. of table: for 30 x 30, 1600 lb.; for 36 x 30, 1800 lb.; for 42 x 30, 1900 lb.; speed of cut: standard, 38.5 ft. per minute; special, 30 ft. per minute; return speed, 90 ft. per minute.

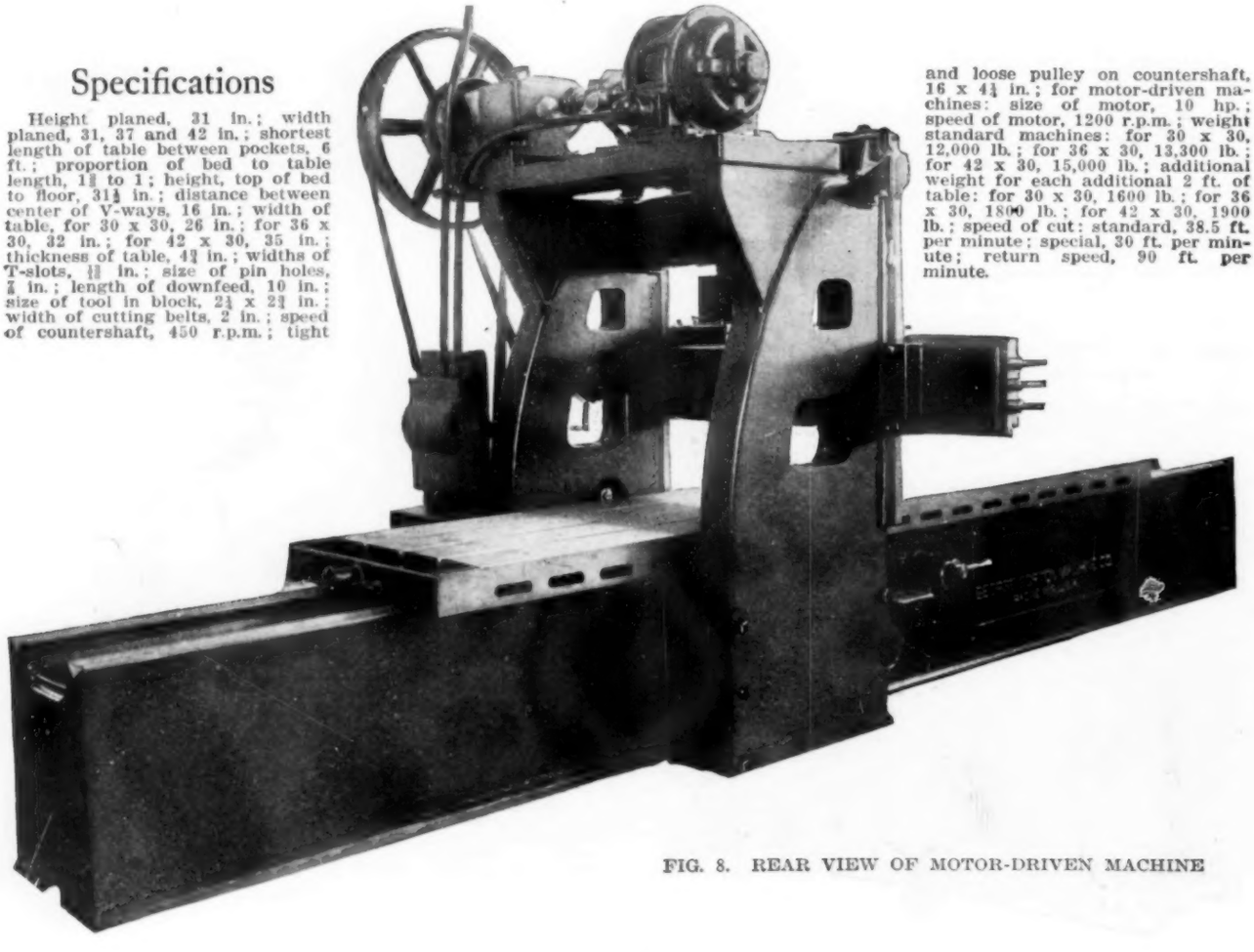
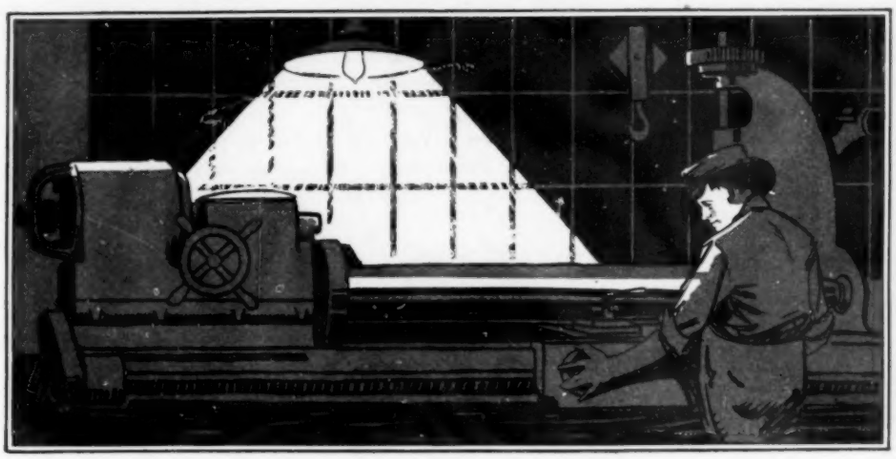


FIG. 8. REAR VIEW OF MOTOR-DRIVEN MACHINE



LIGHT, ELECTRICITY and The Shop

By C. E. Clewell

The Control of Direct-Current Motors

PRACTICALLY all motors possess in some measure the inherent qualities to suit them to the loads, for the driving of which they are installed. In other words, the direct-current motor, as the type under discussion, automatically adjusts itself to changes of load, slowing down when the load is increased and rising in speed when the load falls off.

On the other hand, very few if any motors for shop use possess all of the qualities in themselves to meet the conditions of successful operation in starting and stopping and speed adjustment, and it is in the performance of these functions, more or less in the form of a supplement to the inherent qualities of the motor itself, that the controller performs such an important part.

The controller has gone through numerous developments until today the control equipment on the market possesses a high degree of perfection, performing functions automatically which formerly were accomplished by hand, and incorporating many new features to facilitate production and to safeguard the motor as well as the machine operator.

The importance of suitable control equipment for shop motors and the function of the controller in starting and stopping the motor and regulating its speed are here discussed. Notes are also made on remote control, protection for the motor in case of failure of the supply of voltage or of an excessive overload, reversal of rotation, limitation of current during acceleration to safe values, and the like.

From this standpoint, therefore, it is desirable to consider the controller and the motor together as a unit in the supply of power.

The resistance of the armature of a direct-current motor is purposely made very small so as to keep the internal losses of the motor down to a small value during its operation, and in the case of the adjustable-speed motor this feature keeps the speed very nearly constant at all loads when the speed has been set to any given value; that is to say, the speed falls off only a small

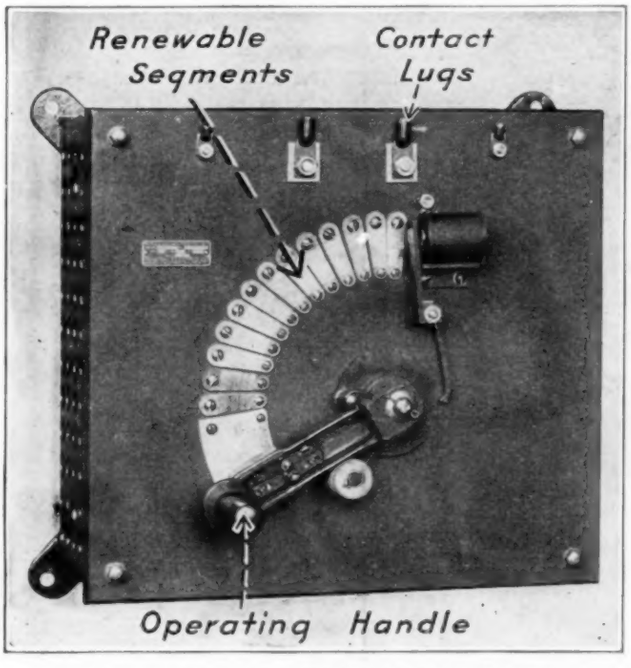


FIG. 1. TYPICAL FACEPLATE CONTROLLER

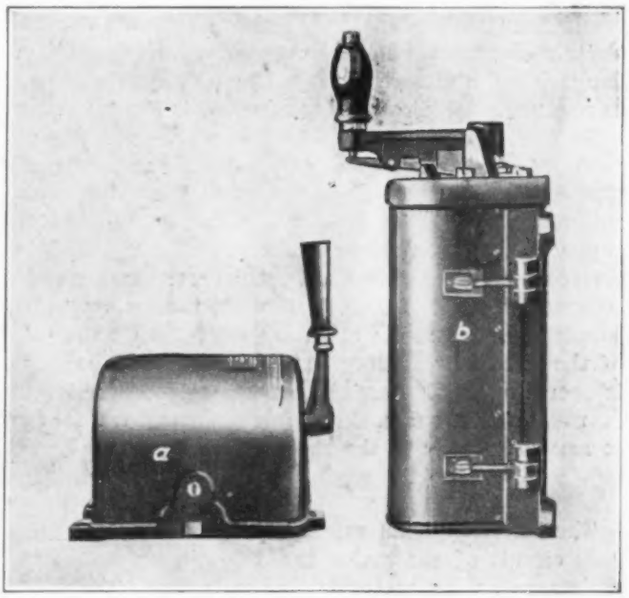


FIG. 3. OPERATOR'S SWITCHES FOR USE WITH THE ACCELERATING AND STOPPING PANEL WHICH IS SHOWN ON NEXT PAGE IN ILLUSTRATION, FIG. 4

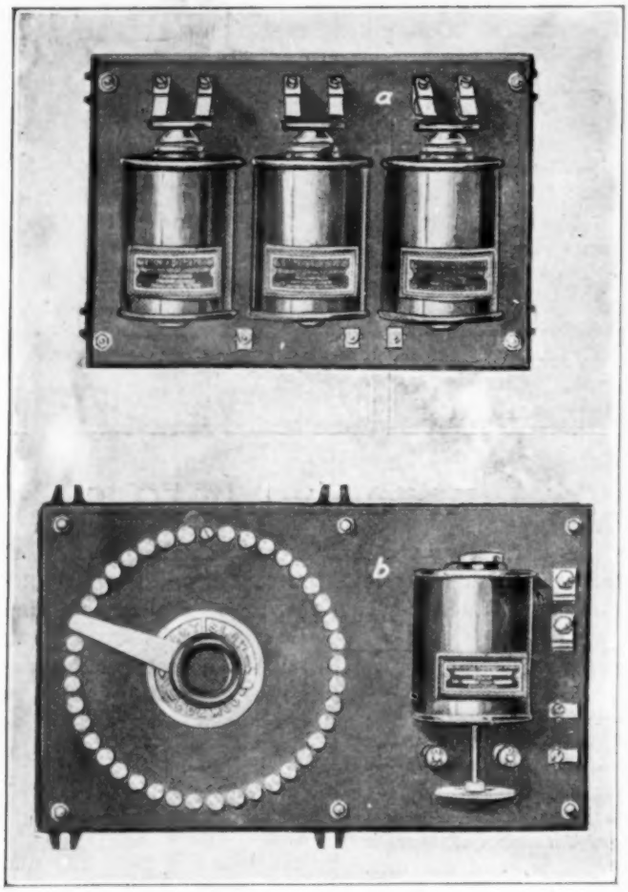


FIG. 4. ACCELERATING AND STOPPING PANEL (ABOVE); FIELD RHEOSTAT AND OVERLOAD PROTECTION (BELOW)

amount if the load is increased or its rise in speed is small if the load is thrown off.

While low resistance of the armature is a great advantage in these points it introduces a factor at starting which must be carefully considered; that is, to throw such a motor directly onto the supply mains would tend to produce an excessively high inrush of electric current through the motor, which besides endangering the motor would subject the supply circuits to an unduly high voltage drop which is likely to prove a disadvantage to other machinery on the same circuits.

To overcome this, an auxiliary resistance is usually placed in series with the armature of the motor, being sufficiently high when the motor is thrown onto the supply line to keep the current down to a safe limit. As soon as the motor starts, this resistance may be reduced, since the motor by its own motion develops a counterpressure in its armature, this taking the place of the external auxiliary resistance. When the motor is operating at its normal speed all external resistance is usually cut out and the motor armature is then connected directly to the supply circuit.

THE FACEPLATE CONTROLLER

The insertion of an auxiliary resistance in the armature circuit of the motor and the cutting out of this resistance as the motor speeds up are two important functions of the motor controller. In the earlier types the device for starting took the form of a "faceplate" hand-operated starting rheostat, somewhat as shown in Fig. 1, and this form was mechanically suited to the use of a fairly large number of steps in cutting down the auxiliary resistance during the process of starting the motor.

Two or three reasons made it necessary in earlier practice to have a good many steps for the operating handle of such controllers to traverse during the starting operation. One of these was the tendency of the motor to spark, or flash, if subjected to excessive current; another was the danger of sparking and burning of the rheostat contacts if the change in current per step was too great, and still another was the difficulty of voltage fluctuation if too large a peak of current was felt by the line at any point in the starting period.

The numerous segments on the typical faceplate controller avoided these difficulties by making the change in current flowing into the motor so small when the rheostat handle was thrown from one segment to the next as to avoid any of the troubles mentioned. The development of both motors and controllers has minimized these limitations, and it is no longer necessary to incorporate so many starting steps for small and medium-sized motors.[1]

Published figures show that direct-current series and compound motors as large as 20 hp. are operated successfully without any external starting resistance, and that shunt motors as large as 15 hp. are being operated by drum-type controllers which short-circuit the starting resistance in a single step. In certain cases, however, motors corresponding to these sizes must be equipped with controllers which cut out the starting resistance in two or more steps to take care of special requirements in the machinery being driven.

The drum controller for machine-tool work is illustrated in Fig. 2. It possesses distinct advantages over the faceplate type, among which may be mentioned the convenience in the operation of the handle, the facility in breaking contacts under heavy current flow by the contact-fingers arrangements on such a drum, and the use of magnetic blowout coils for extinguishing the arc.

[1]See paper by H. D. James, *Trans.* Am. Inst. of Elec. Eng., Vol. XXXVI, page 254, to which several references have been made in the preparation of this article.

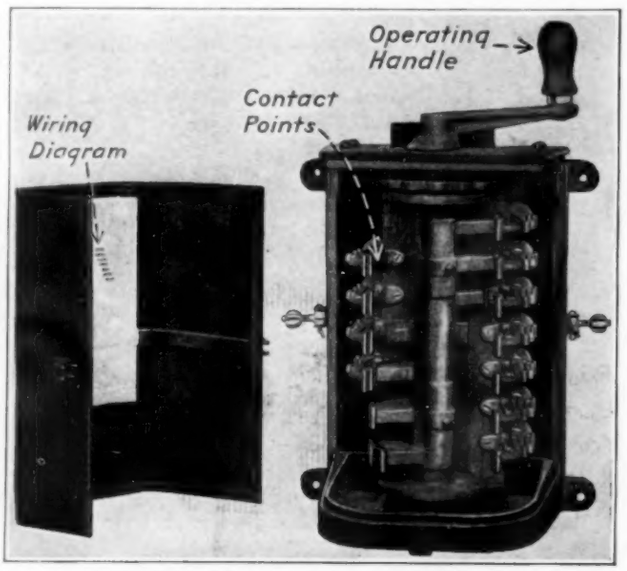


FIG. 2. INTERIOR OF DRUM-TYPE MOTOR CONTROLLER, INCLOSING CASE TO THE LEFT

Moreover, the inclosure of the contracts by a protecting case is an advantage to the operator.

In both Figs. 1 and 2 the controllers are manually operated; that is, all the starting functions are made by hand, and the judgment of the operator is depended upon in the rapidity with which the handle is thrown around to the full running position. The advantages of the hand method of starting as compared with automatic schemes are cheapness in construction and simplicity of design and operation, and where the operator's judgment is good smoother acceleration can sometimes be accomplished for the motor than by automatic means, this last statement applying particularly to motors for which the starting loads vary from time to time. On the other hand to depend on the judgment of an operator for smooth motor acceleration may often be an actual disadvantage, due to his failure to exercise good judgment in handling the controller, and, besides, the fact that he comes in contact with the device means the possibility of a burn or of an electric shock, and in the larger sizes of controllers the physical exertion of hand manipulation may be sufficiently great to be a serious handicap in the routine operation of the motor drive.

One of the most noteworthy developments in motor-control apparatus has been that of the application of magnetic contactor switches to automatic-control devices. By means of these automatic-control outfits the acceleration and often the braking rates of the motor are governed by magnet switches, which may be set or adjusted so that the motor accelerates in such a manner as not to take excessive current from the supply mains. In other words, the operator merely throws a master switch or pushes a button, all the functions normally performed in earlier types by hand regulation being governed entirely by automatic equipment.

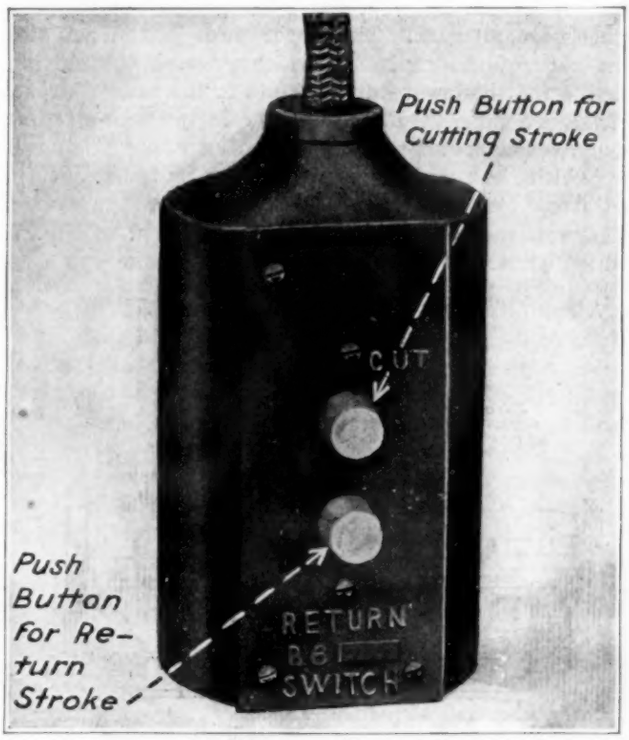


FIG. 5. PENDANT SWITCH FOR A REVERSING MOTOR EQUIPMENT

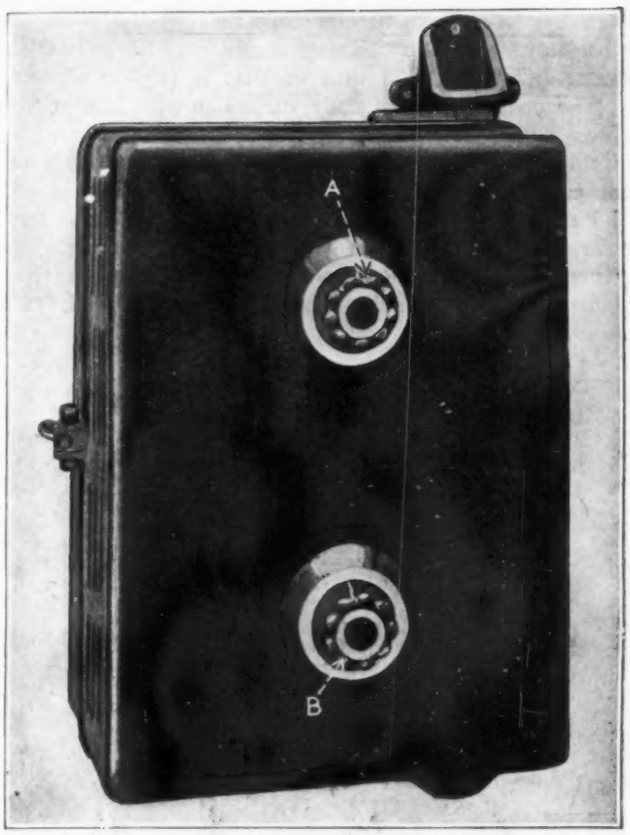


FIG. 6. A PANEL INCLOSING CASE FOR 35- TO 50-HP. REVERSING MOTOR

Many advantages will be apparent by the adoption of this scheme. For example the possibilities of remote control, whereby the automatic starter may be actuated by the pressing of a push button removed at a considerable distance from the motor and its controller, and even the function of the push button itself, may be performed by a float switch placed in a water tank and arranged to start a motor-driven pump at such times as the water level drops to some prescribed point.

Moreover, these automatic devices may be made to limit the current at any point of the starting operation to any given higher limit, this being a feature which may be important in some cases, due to the effects on the supply circuits produced by sudden large-current peaks.

Acceleration and Speed-Changing Equipment

To illustrate some typical equipment of the automatic[2] controller Figs. 3, 4, 5 and 6 are shown at this point. Fig. 3, (*a*) and (*b*), indicates what are termed operators' switches for establishing the different electrical connections for the starting, the stopping and the reversing of the motor. In cases where it is not convenient to mount the switch itself at the operator's normal working position it is quite common to employ some form of mechanical connection between the switch and the operator's working point, this being accomplished by gears, chains or other means.

[2]Figs. 3 and 4 are due to the Electric Controller and Mfg. Co., several of whose bulletins were consulted in preparing the description of these devices; Figs. 1, 2, 5, 6 and 7 are due to the General Electric Co.; Fig. 8 to the Reliance Electric and Engineering Co., and Fig. 9 to the R. K. LeBlond Machine Tool Co.

In Fig. 4 (*a*) an accelerating unit in the form of a series of contactor switches is shown. Suppose that the main switch, like that of Fig. 3 (*a*), is thrown by the operator to its fully turned-on position. This places full external starting resistance in the armature circuit of the motor and thus limits the first inrush of the current to the motor. The motor now speeds up, and as the first inrush of current falls off, a point is soon reached where the first switch of the unit in Fig. 4 (*a*) is closed and a portion or all of the starting resistance is cut out automatically. The motor is thrown directly on the line when the third switch is closed.

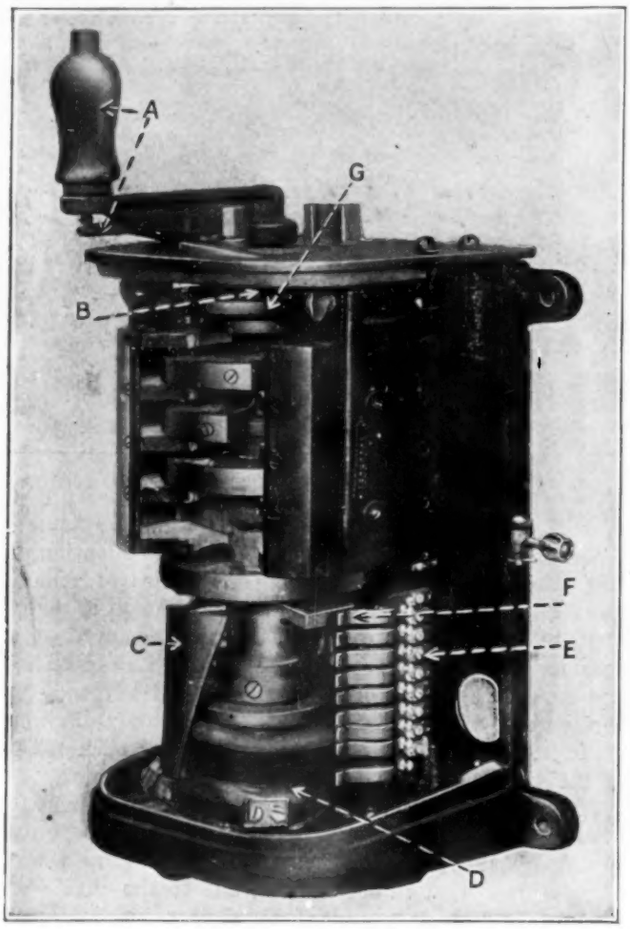


FIG. 7. A TYPICAL MACHINE-TOOL DRUM-TYPE CONTROLLER

The master switch may be thrown to a "drift point" after the motor is in normal operation, cutting off the supply of current and merely allowing the motor and its machine tool to stop by friction. Another position of the main switch is known as the "off" point, at which the motor is automatically braked by the so-called dynamic scheme, in which the momentum of the moving parts of the machine, in keeping up the motion of the motor, converts it for the moment into an electric generator. The motor by this temporary generator action sends a current through a resistance placed across the armature, and this tends to stop the motor very quickly. Both the acceleration and the dynamic braking actions can be made very smooth by proper adjustment of the various switches as in Fig. 4 (*a*).

The most common method of adjusting the speed of

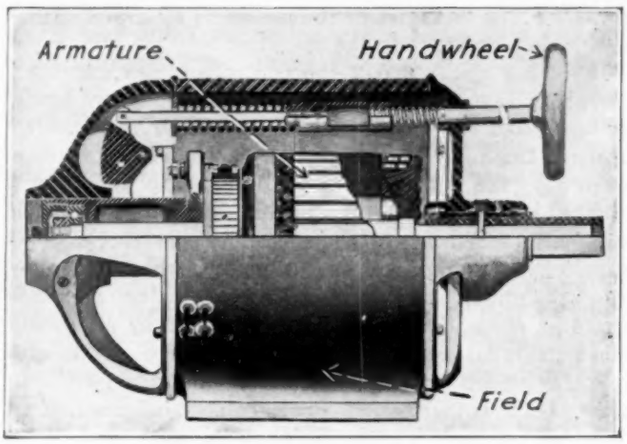


FIG. 8. CROSS-SECTION OF AN ADJUSTABLE-SPEED MOTOR OF THE ARMATURE-SHIFTING TYPE

direct-current motors is to change the field current. This is usually done by inserting in the shunt field winding of the motor an adjustable resistance, the value of which is increased to increase the speed and decreased for lower speeds. Fig. 4 (*b*), to the left, shows such a field rheostat, the handle of which when turned in a clockwise direction slows down the motor, and vice versa.

As a protection against excessive overloads a device known as a relay is placed on the right of the panel in Fig. 4 (*b*), this relay automatically cutting out the shunt field rheostat resistance and operating the motor at a reduced speed if the load becomes so great as to endanger the safety of the motor. All the apparatus shown in Fig. 3 (*a*) and (*b*), and Fig. 4 (*a*) and (*b*), may be used together, constituting in such a case the combined control equipment for a given motor.

Fig. 5 illustrates a device, known as a pendant switch, for use ordinarily with the reversing motor planing-machine equipment. The upper push button actuates the part of the controller which governs the cutting stroke and the lower button refers to the return stroke. Fig. 6 is a panel (also for the reversing planing-machine motor) and shows the two operating knobs *A* and *B* by which the speed of the motor may be independently adjusted for the cutting stroke and for the return stroke of the planer. Attention is directed to Fig. 7, which shows a modern machine-tool drum-type con-

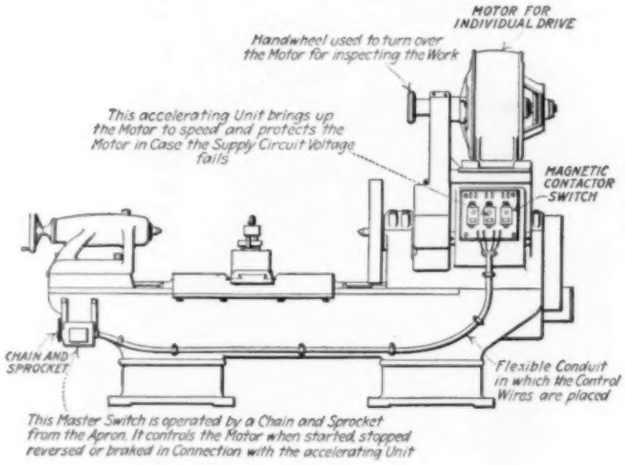

MOTOR FOR INDIVIDUAL DRIVE
Handwheel used to turn over the Motor for inspecting the Work
This accelerating Unit brings up the Motor to speed and protects the Motor in Case the Supply Circuit Voltage fails
MAGNETIC CONTACTOR SWITCH
CHAIN AND SPROCKET
Flexible Conduit in which the Control Wires are placed
This Master Switch is operated by a Chain and Sprocket from the Apron. It controls the Motor when started, stopped reversed or braked in Connection with the accelerating Unit

FIG. 9. CONTROL APPARATUS MOUNTED ON A LATHE

troller, in which *A* is a rust-proof handle provided with a latch that prevents accidental reversal of the motor, *B* the operating shaft made hexagonal to prevent the cylinder from turning on it. A special fiber insulation is used between the cylinder and shaft. *C* is a brass cylinder which, being nonmagnetic, does not distort or weaken the field produced by the magnetic blowout coils *D;* these are used to extinguish the arc at each finger and full-load current may flow through them continuously without injury. *E* is a fingerboard for the stationary contacts; it is made of kiln-dried hardwood impregnated with a moisture-proof compound. At *F* are forged-copper fingers with phosphor-bronze springs and fitted copper segments that are easily renewed. The finger pressure and alignment are adjustable. At *G* a star wheel and pawl insure positive contact on each point.

Speed Control by Armature Shift

One of the exceptions to the common method of speed control by changes in an external shunt field rheostat is that of the armature-shifting type, a cross-sectional view of which is shown in Fig. 8. The handwheel shown at the upper right hand is used to move the armature in and out with respect to the stationary part or magnetic field structure. Withdrawing the armature from the motor frame increases the speed and the reverse decreases it.

This motor operates at a constant horsepower output at any speed over a range which may be such that the ratio of the maximum to the minimum is 10 to 1. The construction of the armature is tapered slightly, and the in-and-out motion of the armature may be performed with exceedingly small changes so that the speed may be adjusted over unusually fine graduations. It is to be observed that the speed change in this type of motor does not require an auxiliary field rheostat of any kind, the speed-adjustment feature being self-contained in the motor itself.

Practical Example of Automatic Control

Fig. 9 gives a general idea of how a complete equipment may be accommodated on a machine tool. The master switch shown at the left is actuated by control from the apron, which allows the operator to manipulate the switch from his normal working position. The accelerating unit (see also Fig. 4 (*a*)) is located directly below the motor and is used to start up the motor at slow speed irrespective of how the rheostat in the field circuit is set. Three switches will be seen so connected into the armature circuit and so adjusted that they close successively and at the proper time in regard to current, thus gradually cutting out the armature resistance as the motor comes up to its normal speed. This accelerating panel is also used to protect the motor from too sudden a start in case the voltage of the supply circuit fails momentarily and then suddenly comes on again.

Numerous advantages may be mentioned for this automatic method of motor control. Among them is the convenience of having the motor under the control of the machine operator either for starting or for a quick stop from the apron. Dynamic braking is an economy from the time standpoint, and one manufacturer cites as a conservative estimate a time saving of fully 25 to 35 per cent. on certain classes of work due to this feature alone. Naturally, too, it is quite an advantage for an operator to be able to start and stop his motor without affecting the setting of the controller, thus making it possible to maintain any given cutting speed throughout a specific job.

Method of Hanging Shafting from Concrete Ceiling

By R. B. Smith

Following is a description of what we consider the best method of hanging shafting in cement buildings:

The nut retainers, Fig. 1, are cast in the ceiling

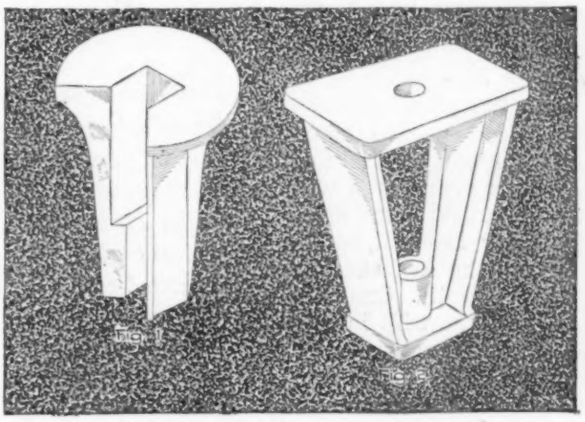


FIG. 1. THE NUT RETAINER

at the time the cement is poured, the bottom being flush with the surface of the concrete. A small cast-iron bracket, Fig. 2, and two 3-in. channels are suspended as shown in the sketch. A spacing washer a little thicker than the diameter of the holding bolt is placed between the channels at every point where they

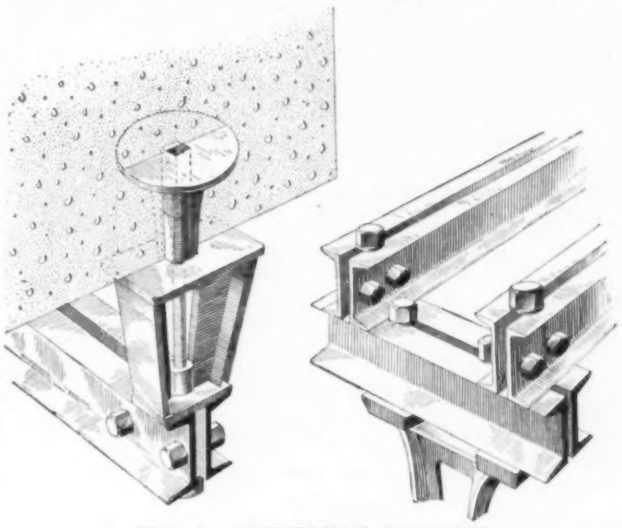


FIG. 2. SUSPENSION BRACKET
FIG. 3. SHAFTING SUSPENDED FROM CONCRETE

are bolted together, allowing the long holding bolt to pass freely between them.

These channels run the entire length of the room parallel to the shaft; the hangers are then mounted on them by means of short lengths of channel iron attached transversely to them with bolts passing between the channels wherever it is necessary to put up a hanger. The hanger is similarly bolted to these two channels.

The Riddle of Dependency—II

By CHESLA C. SHERLOCK

IF THE husband and wife are living together at the time of the accident there is no room for argument on the part of the employer. All that the wife has to do is to prove her relationship to the deceased and compensation will then be payable by the employer. However, some of the statutes are so worded that it is taken to mean that no wife can receive compensation unless she were living with the husband at the time of the accident causing death.

This has given rise to a great deal of contention in the courts and commissions as to the rights of a wife who is in fact living apart from her husband at the time of the husbands injury and death. Can it be said that the wife in such an instance is not entitled to compensation? The courts have been practically unanimous in saying that for the purposes of the compensation act a wife is "living with her husband" provided he contributes toward her support or does support her from his earnings. If such a fact is established, then the wife is deemed a dependent under the compensation acts, regardless of the evident intent expressed in them by a casual reading.

Who Are Dependents?

Continued

This installment continues the discussion of dependents and brings out the effects of desertion, bigamy, divorce and common-law marriages on the making of compensation awards. The status of the alien and his dependents always invites contention, particularly under the present unsettled conditions.

In Wisconsin, it was shown that shortly before the death of the husband the wife had obtained a decree of divorce awarding her the custody of the children and alimony to the amount of $25 per month. The wife applied for compensation as a dependent and the Industrial Commission awarded it to the amount of $25 per month, further holding that this should be in full satisfaction of all claims of either the wife or the children upon the employer. When the case was appealed to the supreme court, however, it was held that the decision was in error and the case was remanded, the supreme court saying that the wife was not a dependent of the husband at the time of his death.

In California, however, the husband had been ordered by court to contribute $5 per week toward the support of his wife. The commission awarded compensation in the amount of $10 per week to the wife and children, holding that they were dependents of the husband.

Desertion Cases

The mere fact that the husband has deserted his wife and has not made his whereabouts known to her and has not contributed toward her support, although she could have compelled him to do so had she known of his whereabouts, will not entitle her to a compensation as a dependent. Nor will the fact that the husband has deserted his wife, in itself, be sufficient to entitle her to compensation. It is generally held that the parties must be living together at the time of the death in order for the wife to receive compensation as a dependent and the question of fault for the separation does not and cannot in itself change the rule. This rule has been supported by the New Jersey and Ohio court and commission, respectively.

An example throwing further light upon the question of dependency is afforded in the Ohio case. It was shown that the deceased was a native of Wales and that he had left his wife there in 1896 and had come to America. In 1900 he came to Ohio and contracted a bigamous marriage with a woman who did not know that he had another wife living and who supposed that she was his lawful wife. From this time until his death they lived together, he supporting her as his wife. During that time he made no contributions toward the support of his lawful wife in Wales. It was held that the lawful wife was not entitled to compensation as his dependent, but that the bigamous wife was the dependent to whom compensation was due.

Temporary Separation

The mere fact that the husband and wife were temporarily separated at the time of the accident will not discharge the employer's liability to pay compensation to her as a dependent. The California commission so held in a case where it was shown that for two months prior to the accident, the wife had been visiting a sister in another state and planned to join her husband a week after the date when he was killed. They were presumed to have been "living togther" within the purpose of the compensation act. The fact that the husband is compelled to be absent from his wife by reason of his employment will not defeat the wife's right to compensation, even though it be shown that she was compelled in his absence to largely support herself. This rule is particularly applicable in cases of aliens or nonresident dependents.

Likewise the mere fact that the husband was prevented by lack of employment from contributing toward the support of his wife shortly before his death will not prevent her being considered as his dependent.

Speaking of this matter of separation, the Wisconsin court has said: "Proof of total dependency is dispensed with under the statute where the husband and wife are 'living together' at the time of the death of the injured employee. It seems, therefore, quite obvious that the legislature intended by the use of the words to include all cases where th[illegible] is no legal or actual severance of the marital re[illegible] though there may be physical separation of the parties by time and distance. The 'living together' contemplated by the statute, we think, was intended to cover cases where no break in the marriage relation existed, and therefore physical dwelling together is not necessary in order to bring the parties within the words 'living

together.' There must be a legal separation or an actual separation in the nature of an estrangement, else there is 'living together' within the meaning of the statute."

Common-Law Marriages

In the case of a common-law wife, the question of whether she shall receive compensation as his widow will depend upon the law of the place where the alleged marriage took place. If common-law marriages are recognized there, they will be recognized anywhere, regardless of the law of the place of the accident concerning such marriages. Thus the California commission awarded compensation to a common-law wife, married in Ohio, because such marriages were recognized as valid in Ohio.

In Massachusetts, it was held that the employer was not bound to pay compensation to a woman who had been living with the workman in illicit relationship, when it was shown that he was a married man who had never been divorced.

In California, a woman alleged that she was the widow of the deceased, but it was shown that she had never been married to him. The commission held that the evidence was insufficient to establish dependency. Such relationships generally will not establish dependency, although the woman might have been termed a "dependent" in a technical sense, because they are against public policy and will never be encouraged. Employers are justified in refusing compensation in such instances and will be upheld by the courts and commissions.

Child

Under the American acts, a minor is generally conclusively presumed to be a dependent of a deceased workman. In England, the question of dependency is wholly one of fact to be determined by the evidence in the case. Because of the presumption in this country, there is not much room for discussion, the employer usually being held to pay, regardless of the objections he may raise.

In cases where the child is living apart from her father at the time of his injury and death, it was held in Ohio upon a showing that he paid her board and room rent and furnished her with money to buy clothing, that she was a dependent and entitled to compensation.

Where the child is over age, the question is one of fact to be determined according to the evidence in each case. If the child is of weak physical condition and living at home, helping with light housework but unable to do much, it was held in Wisconsin that the extent of her dependency was to be determined by the difference between the value of the service rendered and the value of her support.

If there has been a divorce and the child has been awarded to the mother, no order being issued upon the father to support such child or contribute toward it, there is no presumption of dependency in favor of such child. However, if the father voluntarily furnishes money to support such child, then there is sufficient evidence of dependency to establish such status in favor of the child.

A posthumous child will be deemed a dependent under a rule of law whereby a posthumous child is to be regarded as already born if it be for his benefit, and such a child may rank as a dependent. The same rule applies in the case of a posthumous illegitimate child where the father has recognized it as his own and has made arrangements to marry the mother and has provided to support her and the child. Where the illegitimate child is living with the parents and has been supported by the father, such child is entitled to compensation as a dependent in the same manner that a legally born child would be entitled to it.

In New Jersey, it was held that dependent stepchildren who have been supported by a deceased workman are "children" within the meaning of the compensation act of that state and may be treated as dependents.

Sister

A sister may be found to have been the dependent of her brother, when it was shown, as it was in an Illinois case, that the brother had paid her household bills in addition to a stipulated weekly amount for board and room, for more than two years prior to his death.

In Ohio, it was shown that a workman had paid the entire bills of his mother and sister, with the exception of the pension money the mother received. It was held that the sister, even though 24 years old and apparently able to support herself, was a dependent and entitled to compensation as being "practically totally dependent" upon the brother. The mere fact that the brother has given sums of money to a sister not living with him, and who is earning a regular wage sufficient to support her, will not establish dependency, as was held in another Ohio case.

It has also been held in Ohio that half-sisters and half-brothers who were supported entirely by the earnings of the deceased workman are wholly dependent upon him and may take compensation in the same manner that full sisters and brothers would.

Aliens

In the question of the right of aliens to take compensation as dependents, we come to a question which has been of particular interest to employers during the last two years. Most of the compensation acts make provision to the effect that aliens and nonresidents are entitled to compensation in the same manner as dependents that are residents of this country would be entitled to it. In some states the amount awarded is reduced, but an award is made, and in still other states the award is to be based upon treaty obligations with the other countries of which the aliens claiming dependency are citizens.

But a careful examination of the intents and purposes of the compensation system clearly demonstrate the fact that there is really no legal justification for the payment of compensation to nonresident aliens as dependents, although American employers have been required to do so since the establishment of the compensation system, merely because the statutes contained some such reference.

Those who recall the principles underlying the compensation system remember that the purpose was to make society or industry share with the unfortunate workman his loss of earning power or impairment of efficiency, he having contributed something to society during his productive term of employment. It was urged that compensation should be paid to dependents for the reason that they would become public charges if industry was not required to make such payments.

It may be true that an alien workman who comes to this country for the express purpose of making

money and returning to his own land when he has accumulated the sum he has in mind, has contributed something to American society in a narrow sense, but it is not true in the larger sense. He may be at heart not in sympathy with our institution or ideals. He may have no interest at heart but his own interest. He takes everything but gives nothing in return, certainly no more than merely enough to get his wages. He has no intention of becoming an American citizen and in joining in our ideals. Yet American employers are generally required to pay compensation to his dependents in the same measure that they are required to pay it to the other foreigner who brings his family with him, becomes a citizen and in a very large way contributes something to our society, at least by announcing that he is in sympathy with it by joining it. On the other hand, the alien who leaves his family in Europe or elsewhere does not present the same problem to society that the man who leaves his family here. They can in no sense become public charges of any American commonwealth. They have contributed nothing to us; what do we owe them?

Some courts have taken a very decided stand on the question, awarding compensation to these alien dependents, but it seems to the writer that the minority opinion of the California court is nearer the real law in the matter than any decision handed down in America. This opinion declared that no state should use its police power to compel American employers to divide their property with the residents of foreign countries, under the circumstances mentioned above.

American employers do not object to paying compensation to dependents in this country, where they can be located and interviewed, but they do object strenuously to paying compensation to people they have never seen and do not know, in fact, exist.

There can be no doubt, and the writer is familiar with a number of instances, where grave fraud has been practiced upon American employers by persons in foreign countries claiming dependency and obtaining it, when in justice they were not entitled to it.

If a foreign workman dies in America, the consuls and diplomatic representatives of the country where the dependents reside always present a fund of evidence which the American employer has no way of substantiating, and he must pay compensation. Whether the dependent actually gets all the money, is a problem never solved.

Certainly these aliens coming to this country should at least be required to become citizens before they secure the benefits of the compensation act. If they refuse to do that, then they should be denied the benefits of this humanitarian legislation. American employers should not be compelled to divide their property with such persons or their dependents, and it is a matter for American employers to call to the attention of their respective legislatures.

Generating Racks in a Shaping Machine

By S. J. Morgan

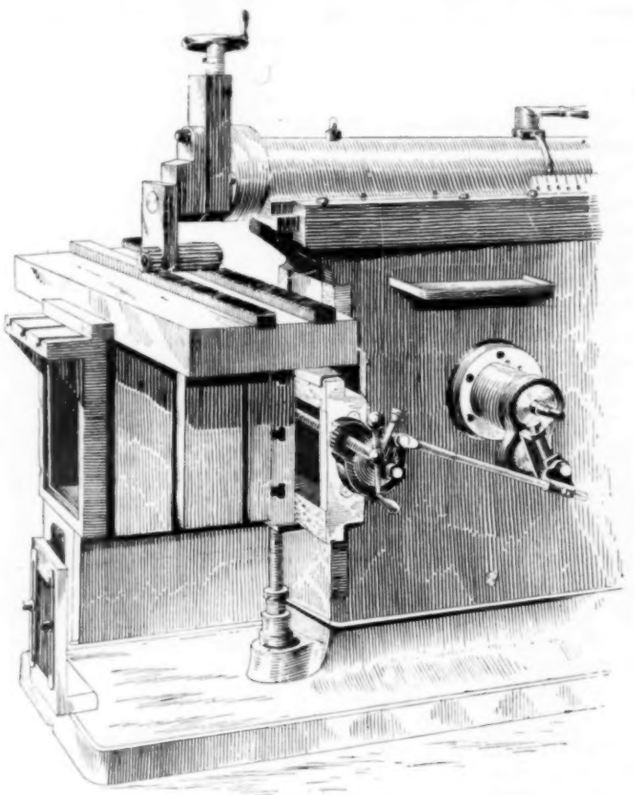
The assembly drawing shows a device for cutting toothed racks in the shaping machine which is simpler than the one described on page 554, vol. 50.

The pieces to be cut are cast-iron sleeves of the form that is commonly used in sensitive drilling machines, and a fixture was made to hold the work. A rack of the same pitch as the one to be cut, but longer and wider, formed a part of the fixture.

A cutter, made upon the principle of a Fellows gear-shaper cutter, was mounted upon a shaft that had one support in a universal bearing attached to the vertical slide of the shaping machine in place of the apron. The other end of the shaft was supported by a fixed bearing attached to the under side of the ram.

The universal bearing was attached to the slide by links in such manner that while the pressure of the cut held it in contact with the slide at its lowest point, it was free to swing upward and away from the face of the slide on the return stroke, this movement being accommodated by a universal joint in the shaft and the fact that the shaft was free to move endwise in this direction.

Clearance for the cutter is assured by the angular position of its supporting shaft, and while this involves a cutter tooth slightly longer than the theoretical



CUTTING RACKS OF THE SHAPING MACHINE

value, the difference is so slight as to be negligible in this case. The well-known irregularity of movement of the universal joint does not enter into the problem, as the shaft is always in a straight line on the cutting stroke. The thrust of the cut is borne partly by the universal bearing, and partly by a collar before the fixed bearing.

Attached to the cutter shaft at the universal joint is a pinion which by rolling in the master rack establishes the correct relation of cutter to work.

The cutter is calculated as a 36-tooth involute gear of the desired pitch, but 12 of these teeth are cut away to the root circle. The sleeves have but 24 teeth in them with solid metal at each end; therefore, by making the cutter in this way, it is possible to feed the work forward or backward with no necessity for vertical movement after the depth of tooth is adjusted on the first rack. A rack is thus completed at each single pass of the table in either direction.

The British 8-in. Howitzer—II

By I. WILLIAM CHUBB
European Editor *American Machinist*

This installment includes the many operations on the jacket, building or assembling the two A-tubes and the jacket by shrinking, lapping and rifling the bore and the inspection of all completed work. Some notes are given in this article on the method of removing the A-tube and putting in a new one where this becomes necessary from wear in action.

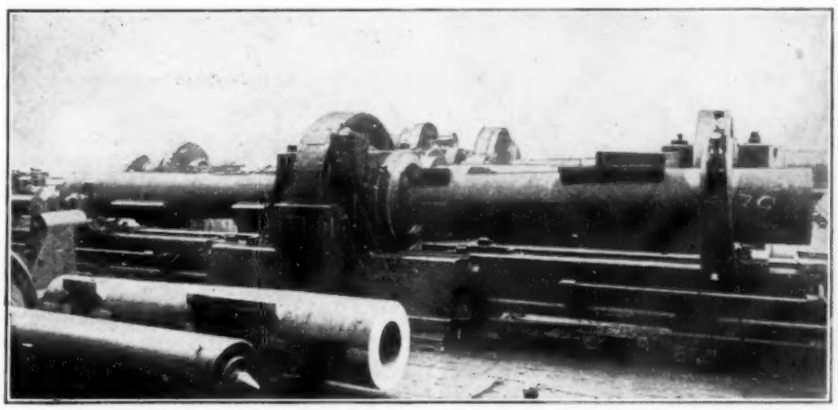


FIG. 12. ROUGH-BORING TWO JACKETS

THE 8-in. howitzer jacket has the guide feet machined from the solid, and the forging may itself be solid or hollow, with the portions intended for the feet either square or circular. The forging for the latter case is shown in Fig. 4. When finished the jacket is 94.6 in. long, with a maximum outside diameter of 19.75 in. and tapering to a minimum diameter of 15 in. It is threaded externally and internally to suit the breech ring and the breech bush respectively and is bored to suit the wiring and shoulders on the outer A-tube.

Operation 1.—Rough-Turn—The jacket is gripped at the muzzle end by chuck and supported at the other end by a star center. By means of a parting tool the corners of the squares or other projections for the feet are roughed down so that an ordinary tool can run into the grooves thus formed. All turning possible is done, leaving the portions for the feet to be planed. Generally, $\frac{3}{4}$ in. is left on all diameters. The work is done dry by means of $1\frac{3}{4}$-in. square tools, the cutting speed being 15 ft. per minute, and the feed about 16 per inch. Two carriages are employed, one tool to each.

Operation 2.—Plane Feet—First the fitters mark out the form of the feet by scribed lines and center punch, about $\frac{3}{4}$ in. being left at the feet thickness for the finishing operations. The job is then planed, being supported in V-blocks on the table of the planing machine. The feet are roughed out first and then the corresponding circular portions of the periphery. For this about a dozen flats are planed on the exterior in order to rough out the form, the job being shifted in the V-blocks to suit. Tools $1\frac{1}{2}$ in. square are employed, and the depth of cut may be as much as $\frac{3}{4}$ in., the feed being 48 to the inch.

Operation 3.—Rough-Bore—The jacket may be bored from the solid or the forging may be hollow. Fig. 12 illustrates a double-ended machine ooring from the solid, the jacket being gripped and driven in the central chuck by screws and supported at the ends. In this machine the central hollow headstock has a tube running in capped bearings and driven by a variable-speed motor through gearing. Right- and left-hand slide beds are connected to a central bed, each with guide screw, carriage, boring-bar bracket and support. At each end are feed-gear brackets for actuating the carriages and boring-bar brackets independently, each bracket having its own constant-speed motor. The clutches on the feed-motion shaft are controlled by handwheels on the shaft in front of the bed, and while the quick return is at constant speed the feed can be varied by the change gears. A surplus length, say 10 in. to 12 in., is left on to act subsequently as a bearing. The hole put through is usually about 10 in. in diameter.

Operation 4.—Heat-treated.

Operation 5.—Cut off test pieces.

Operation 6.—Re-turn and Finish-Turn—First, a cut leaving about 0.015 in. on the diameter is taken, the speed being about 18 ft. per minute and the feed 16 to the inch. Then by a flat-face tool, $1\frac{1}{8}$ in. broad, three cuts are taken to finish, the feed being $\frac{1}{4}$ in. per revolution. The jacket is turned between the feet and also at the two ends to form bearings.

Operation 7.—Rebore—A through bar is used of from 8 in. to 10 in. in diameter. The work is driven by a

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central chuck and runs on two bearings, one being the surplus material at the end. A push rod and a single-point tool about 1¼ in. square in section are employed, the cutting speed being 18 ft. per minute and feed about 8 in. per hour, being about the same as the corresponding operation (6) on the A-tube. About 0.3 in. is left on the diameter.

Operation 8.—Finish-Bore—In the boring machine the jacket is held by a four-jaw chuck. The small end of the jacket is bored out parallel first to finished size, two finishing cuts being taken by a broad tool. The bar is then set to the taper and the cut made with a knife tool 1 in. by ⅜ in. section, with a cutting speed of

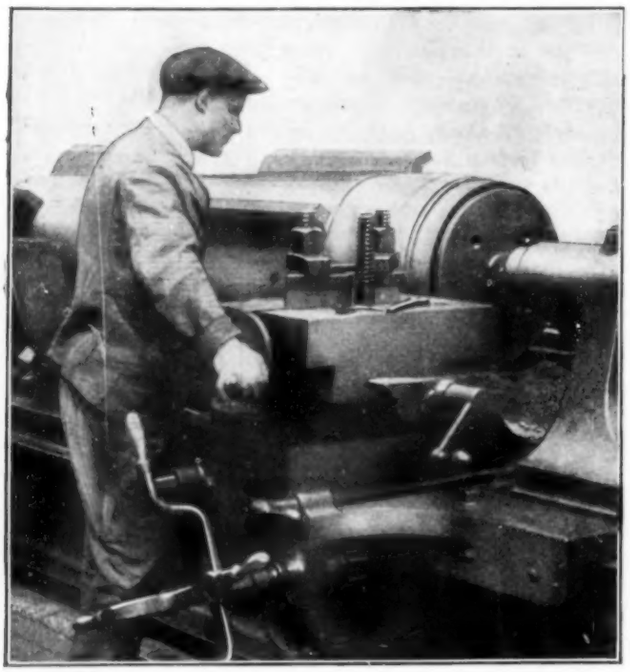

FIG. 13. THREADING JACKET FOR BREECH RING

15 ft. to 20 ft. per minute and a feed of $\frac{1}{16}$ in. per revolution, leaving about 0.05 in. to come out. This is followed by a broad finishing tool taking out about 0.045 in., the cutting speed being 12 ft. per minute and the feed 0.15 in. per revolution. The taper bore is started at the breech end and terminates to plan length. The A-tube being wound, the diameters over the wire are taken, the jacket being bored as nearly as possible to these, leaving about 0.01 in. to come off the wire at the final turning.

Operation 9.—Second-Plane Feet—First the form is marked out in the usual way by fitters, about $\frac{1}{10}$ in. being left on for final machining. The jacket is carried at one end by a revolving head with worm gear and the other in a split bush-and-taper center, being also supported on rollers at the muzzle end. Two cuts are taken in this process, roughing and finishing, the speed being about 35 ft. per minute and the feed about 32 cuts to the inch. One head is thrown over in order to finish the radius between the feet and the body at each side. Then the heads are put on taper blocks in order that taper portions at the feet may be circular-planed. The revolving head is made to suit the end of the jacket. The radius on the end of the jacket by the feet is started by hand; that is, by chipping and filing, and is finished by pulling round in the lathe to the stop and start positions thus produced.

Operation 10.—Build.

Operation 11.—Thread for Breech Bush—The muzzle end is held in a four-jaw chuck and the breech end runs in a steadyrest. The job is ordinary screw cutting, the thread produced being tested by a cast-iron threaded plug with a pigment on the threads and on the face to insure bedding. A start of thread gage is employed. In subsequent lathe operations a threaded plug is inserted in the breech bush opening. It is centered on the outer face and has 1¼-in. tapped holes to take bolts for a pinch bar for screwing up and removing. This prevents damage to thread. This applies when threading for breech ring, as in Fig. 13.

Operation 12.—Finish-Bore and Finish-Chamber—The work is held by the muzzle end in the chuck and the breech end in a steadyrest, and the boring is from the muzzle to the breech. It is rebored to within $\frac{1}{10}$ in. of size with another double-ended tool on the same bar, having wooden bearing strips behind the cutter to fill the bore. The speed is about 20 ft. per minute.

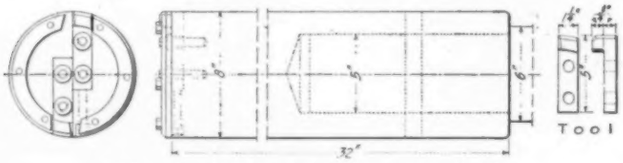

FIG. 14. HEAD FOR FINISH-BORING

For fine boring a head of the type illustrated in Fig. 14 is employed, the work being held in the center by the boring-machine chuck and supported at the two ends in steadies. The breech end is at the back, and for the purpose of the operation is closed by a wooden plug which at the center has a relatively small hole through which oil is poured into the interior of the gun. The boring head carries two tools let into slots in the face, and each tool is adjusted for diameter by screws. The shank of each tool is fastened to the face of the head by ⅝-in. screws, the corresponding holes in the boring tools being slotted to permit adjustment. The tool shanks are 1¼ in. by ¾ in. in section, and the operating faces project at right angles. In front of the bar are two half rings of india rubber clamped in position by plates to suit. The purpose is to prevent the oil escaping from the tube, the cuttings also being pressed forward. The head shown is solid. Generally behind the tool, to act as a guide, is a cast-iron block about 4 diameters long and 0.004 in. below the size of the bore.

It is usual to leave about 0.05 in. on a side to be taken out at this last operation. The speed is slow, to prevent heating, say 4 to 6 revolutions per minute, the feed being about 6 in. per hour.

The chambering tool is controlled by a former plate inside a bar, the latter being steadied by a bushing inside the bore. This finishes the diameters to within 0.003 in., the remainder being ground out by abrasive wheels. For this purpose an interval grinding attachment, Fig. 15, is used, the spindle being driven by electric motor at about 2500 r.p.m. The final finish to

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the chamber is given by a cylindrical polishing block of wood placed on the end of the grinding spindle and carrying fine abrasive cloth. The grinding spindle receives motion along its own bed by means of a rack and pinion, and the cross-slide gives adjustment as to diameter. Guttapercha impressions are taken while the gun is in the machine to insure correctness of cone and satisfactory finish.

Operation 13.—Finish-Plane Feet, Fit Liners, Etc.—To finish the feet a bar is pushed through the gun carrying three bushes to act as supports, one near the chamber, one at the muzzle and one about halfway between them, narrow rollers being also provided between the breech ring and the feet of the gun. Supported by this on the table of the planing machine, the feet are planed to gage size. Then the liners are put on by the fitter, clamped in position, drilled for the rivets, riveted and planed in position, sized up, dust covers drilled, etc. The feet are finished first at the bottom and sides to over-all and width gages.

Operation 14.—Lapping—For this the work revolves at a speed of 25 ft. per minute, while the lap has longitudinal motion by power. A machine of boring type is used. The breech end is gripped, the muzzle being run on cast-iron pads. The bar to carry the lap is fastened to the saddle of the machine, which must be of at least 36-in. swing in order to allow the feet of the jacket to swing clear of the bed. At the front of the lap bar an iron tongue is secured by a set bolt and lead is cast round it and turned say 0.01 in. below 8 in. in diameter and 14 in. long. In this are six flutes $\frac{3}{8}$ in. wide by about $\frac{1}{8}$ in. deep. A mixture of emery and oil is employed. The saddle carrying the lap receives motion along the bed at about 10 ft. to 12 ft. per minute, the central guide screw of the machine being separately belt driven.

Operation 15.—Rifling—Eight grooves are produced simultaneously, the rifling head having four sets of tools equidistant round the circle, two tools being placed side by side in each case. The usual speed is 14 ft. per minute, varying somewhat with the material of the gun, and the cut is 0.002 in. deep. A detail of the head is given in Fig. 16. The position of the tools is controlled by wedge.

The rifling being finished, the circular brush is removed from the bar and a hardened-steel disk, fitting easily, takes its place. The disk is 1 in. wide by 8 in. in diameter, approximately semicircular on the periphery but with a central land about $\frac{1}{4}$ in. wide. The disk is pushed through the bore to remove the burs left by the rifling process.

For gaging purposes a special appliance in use has a cross-shaped head, bearing on two horizontal arms having spring-held projections which enter the grooves and are revolved by them when pulled through the gun body. At the bottom arm of the cross is a broad projection to fit the bore, while at the top a finger enters the groove to be measured, its position being determined by a wedge set up by a longitudinal screw contained in the pipe stem of the appliance and controlled by a handwheel at the outer end. The stem is of course rather longer than the full length of the tube to be gaged. The gage is pulled through the bore from the breech end to the muzzle, being in this way easier to handle. The stem is marked in inches to show the position of the gage longitudinally in the bore, while the handwheel is graduated to show the depth of groove.

Operation 16.—Pass Bore Templet—A testing plug 7.997 in. in diameter by 36 in. long is passed through the bore.

Operation 17.—Finish for Breech Ring—The muzzle end being held in a four-jaw chuck, a threaded plug is inserted in the breech-bush hole and the breech end is turned to diameter and shoulder gages, $\frac{1}{4}$ in. being left on the length. The outer diameter of the thread is turned to gage, and in screw cutting is brought to full thread, a cast-iron templet testing this. A start of thread gage is employed.

Operation 18.—Fit Breech Bush—In the end face of the bush a slot is formed to take a bar by which it is driven home to a line.

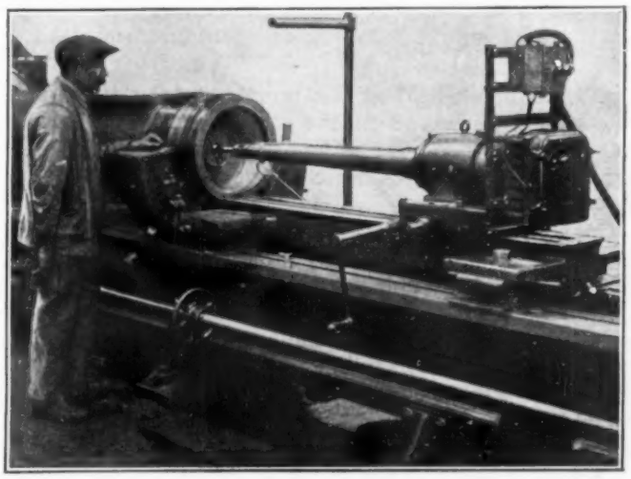

FIG. 15. FINISH-GRINDING CHAMBER

Operation 19.—Breech Ring Shrunk On—The ring is expanded to gage by a gas-jet heating device. This consists essentially of a hot plate to the interior of which gas is admitted. It is expanded about $\frac{1}{16}$ in., this being determined by a pin gage held in tongs and also tested by application of solder to the exterior of the ring, the solder melting at about 350 deg. C. The gas supply is low at first and gradually increased. The ring is carried to the lathe by overhead tackle and lowered in front of the jacket to a definite mark on the horizontal diameter, face and exterior of ring and gun body. The gun is then slowly revolved, while two men press the ring forward, Fig. 17. One man uses a wooden bar as a hand brake under the cone pulley in order that the head may be stopped definitely at a required position. For convenience the lathe faceplate is marked by chalk, the number of turns required being shown here and on the jacket at the breech end. The ring being in correct position, as shown by the horizontal lines scribed, water is turned on through jets in a pipe which extends halfway round the ring, the heavy or bottom side of the ring being cooled first and finally the top half. The time taken for heating is about half an hour, and the cooling-off process takes about a quarter of an hour.

Operation 20.—Finish-Face of Breech Ring, Etc.—

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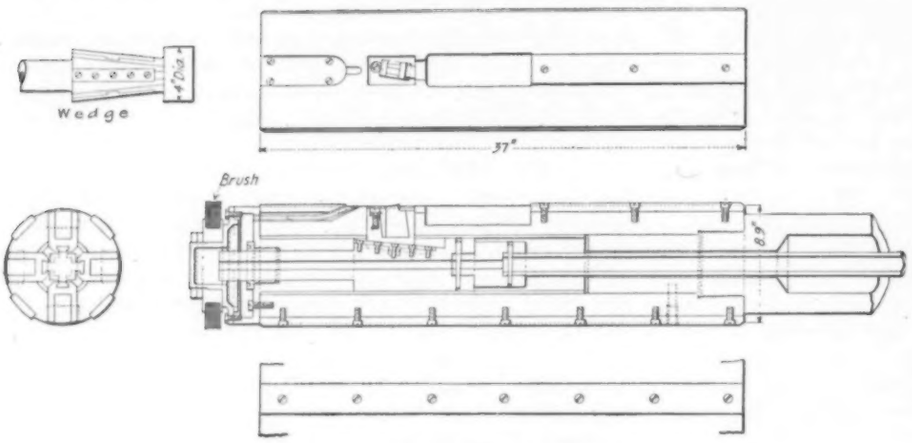

FIG. 16. THE RIFLING HEAD

The work being held at the muzzle end by jaws and run at the other end in the steadyrest. The breech end is finished in the lathe, including finishing the obturator cone seating, which is very important as to taper and position.

Operation 21.—Muzzle Ending—The end is coned down to shape and finished by a radius tool.

The A-tube is shrunk on the inner A-tube, the shrinkage allowance being 0.007 in. on the diameter, and it is important to insure that the shoulders at the breech end of the two parts shall be well home. To be certain of this, measurements are taken before and after shrinking from the breech end to the shoulders. The outer A-tube, muzzle end down, is held in clips on a slab and is heated to about 300 deg. F., allowing an expansion of about 0.03 in. in order that the inner tube may enter easily. The heated gas passes along the bore of the A-tube, much as described later in connection with the jacket. The inner tube is lowered in and when it is in place water is applied outside by rings at the breech or top end.

For the jacket the inner and outer tubes now shrunk together are placed in a vertical position, with the jacket standing at the side about 10 ft. away. The jacket is expanded to about 0.04 in. larger than the gun and is lifted over and lowered on the outer A-tube. The jacket is heated to about 300 deg. F. and the expansion is tested by a pin gage, which is also used to make sure that the bore is kept round, the jacket feet being heated by gas jets at the side so that the temperature may be uniform. The heating takes about 2 hours and is on no account rushed. The gun stands on a foundation plate about 24 in. square by 3 in. thick and is held on a central steel plug about 12 in. long. The jacket is hung from the crane by links. Underneath it is a 9-in. gas pipe through which passes Mond gas, with a sheet-iron baffle plate above, a similar baffle plate being placed on top of the jacket. One man sees that the lower flame is central with the jacket, another similarly regulating the heat at the top. Around the tubes are two water rings, each about 2 ft. 10 in. in diameter, of 1½-in. pipe, and each having in all about 300 jets formed by $\frac{1}{10}$-in. holes. The lower ring is fixed and the upper one movable vertically, being pulled up by wires.

Expanded by heat to the required size, the jacket is lifted by the crane and lowered over the A-tube, muzzle end upward. As soon as the jacket is in place a sheet-iron deflector is clipped on it about 3 ft. down. Water is at once allowed to pass over the top end of the jacket, cooling it out up to about 2 ft. from the muzzle end and including the shoulder at that end, the deflector throwing the water off the lower part of the jacket. Water is also run down the gun bore to prevent stretch here. The top end of the jacket gripping, the deflector is removed and the water allowed to pour down to the breech end, which is drawn up and shortened to position. It is important to exclude drafts during heating.

In the relining program the first object to remove is the breech bush, and for this a plug is made to fit the interruptions in the thread. The gun standing vertically, breech end up, the outside is warmed at this end to about 300 deg. F., the water spray is inserted and the breech bush cooled and slackened from the gun. The plug mentioned then being placed in the interruptions, the bush is screwed out.

Next a plug with waterways right through it is placed in the breech end of the inner tube. The gun stands on the breech end and gas rings are placed around it at 8-in. intervals from top to bottom, the gun body being heated to about 300 deg. F. A spray pipe is then put in at the top and the tube is sprayed all the way down, this contracting the inner from the outer A-tube. A steel tup or bar about 7½ in. in diameter by 15 ft. long and weighing about 1 ton, is then inserted at the muzzle end and allowed to fall the length of the gun onto the plug, bringing the inner tube out.

For relining, the new inner tube is turned to gages with 0.007 in. left on the diameters for shrinkage. The outer A-tube is then held upright by clips in a frame 4 ft. square, muzzle end downward, and the inner tube inserted, being driven down by a 6-ton tup, which is given a drop first of 3 in., then of 3½ in., then of 4 in. and once more at 4½ in. The outer tube, being warmed to about 200 deg. F., is given a flush of cold water for about a minute and then the tup is dropped about 8 in. in order to send the tube right home.

The chief features of inspection are here noted. As to the A-tube, after this has been finish-bored, internal diameters, both vertical and horizontal, are taken and the mean calculated. From the dimensions thus obtained plus the shrinkage allowance, pin gages or set calipers are supplied to which the lathe man turns the inner A-tube. Diameters are taken at about the middle of the lengths of the first two recesses, taking the shoulders at the breech end of the inner A-tube, the third diameter being measured along the tube at about 1 in. from the second shoulder, and other measurements being effected at about 12 to 14 in. intervals along the length, terminating 1 in. short of the muzzle. Gutta-

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percha impressions are also taken of the shoulders and a profile or radius gage is prepared showing shoulders, both as to length and radii. Then a standard-length gage is made from the inner shoulder, and, besides a profile or radius gage, length gage or set calipers, a chart is prepared showing the positions of the measurements.

Next, when the A-tube has been turned the diameters and lengths are checked to the gages supplied. Previous

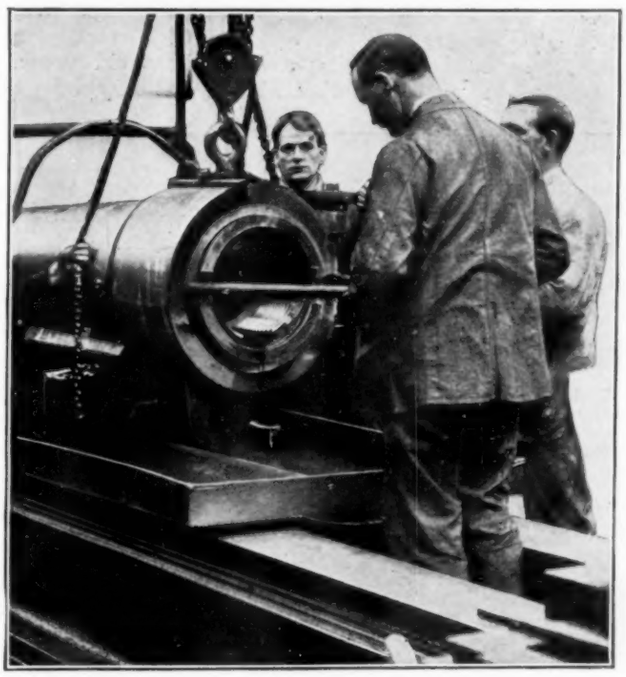


FIG. 17. SHRINKING ON THE BREECH RING

to the building the government inspectors measure the bore at several positions of the outer A-tube and the corresponding diameters of the inner A-tube and check the gages used.

Before building it is usual to take measurements from the first shoulder length of the inner A-tube to the breech end, this including surplus metal. The same process applies to the outer A-tube and also to the muzzle end. The shrinking department can then be supplied with block gages showing at each end the difference in length between the inner and outer tubes, so that it may know when the inner tube is right home. When the tubes are shrunk together the ends are checked by the government inspector with a depth gage, this process applying to both ends.

The inner and outer A-tubes being built, the outer A-tube is turned and the seatings are prepared for the wiring. The turner is given standard diameter gages and length and radius gages, these being checked by the measuring department, and the tube is machined to plan. Before the wiring the government inspector usually takes four or five measurements in the chamber to determine the contraction resulting from wiring, this usually being between 0.008 or 0.009 inch.

After wiring, measurements are taken over the wire, first starting from the breech end 1 in. from the plain part of the tube and when at equal intervals of about 12 in. along the length up to say 1 in. off the last shoulder. The over-wire diameters being measured and recorded, the heat shrinkage is subtracted and the foreman of the borers is supplied with a list of dimensions, pin gages being made to suit.

The borer being satisfied as to his work, the jacket is measured in the same manner as the outer A-tube. Set caliper gages allowing for shrinkage are provided and the wire diameters are finally turned to these gages. The firm's measurers then examine the outer A-tube and pass it from the lathe, the government inspectors also checking. At the muzzle end a gage is made to bear against the shoulder of the A-tube up to a line which is scribed on this tube. Then when measuring the jacket it is usual to employ a hook gage. It is applied from the shoulder and is about 1 in. shorter than the plan length of the plain part of the jacket, a depth gage being used to show with the hook gage the length of surplus metal at the muzzle end.

The scribed line on the A-tube is a building line. After the building it should stand out a definitely known distance, say 1½ in. as previously determined, and when the gun is built the position of the line is checked by a fine rule, or a block gage may be used if preferred.

After the building the gun body is taken to the lathe and the external diameters and lengths are machined. Usually before the jacket is finish-bored its exterior is turned, and after the first bore the surplus length of metal at the muzzle end is removed and the surplus metal is planed off the feet. Pin gages are supplied to the turner for the external diameters and also for lengths between the feet. Also before the A-tube is built in the jacket the taper turning at the muzzle end is finished except as regards radii. The breech ring is turned to standard gages.

After rifling it is usual to measure the depth of the grooves by means of a star gage while the gun body is in the machine, a few points being taken along the length of each groove. With the gun body out of the machine the grooves are measured for depth every 2 in., commencing from the muzzle end.

After the breech ring has been added and the muzzle finish-turned, the mechanism is fitted and the bore is measured horizontally and vertically to set diameters, and the chamber as to length and diameters, according to government directions. When the gun is ready for delivery the firm's measurers check all protrusions, measure the over-all length of the gun, check depth of breech opening, measure the distance between the faces of the breech bush and the jacket and also the distance by which the jacket projects from the breech ring before proof, these dimensions being compared with similar dimensions taken after proof.

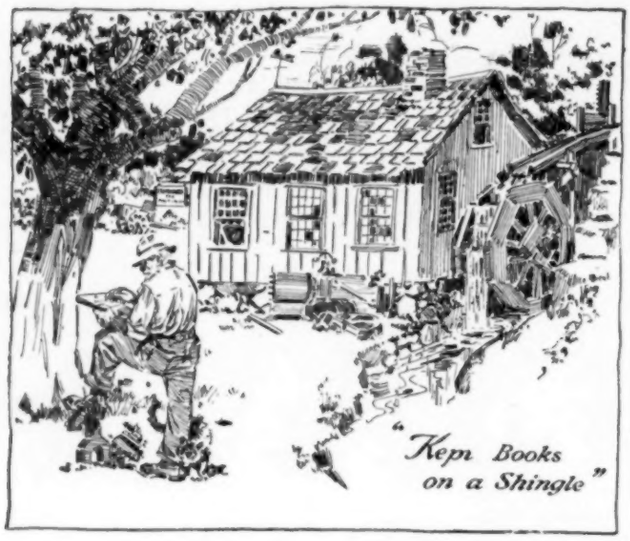
As to war-time tolerances the bore may be plus or minus 0.003 in. along the length rifled where it is usual to keep near the low limit, the tolerance on the chamber diameters being plus 0.015 in. and minus 0.005 in. The tolerance in the finish-turning over the wire is plus or minus 0.002 in. As regards rifling, tolerances for the width of grooves are not more than plus or minus 0.01 in., tolerances for depth being plus 0, minus 0.01 in. The breech-bush diameters are to templet, and as regards the jacket the requirement is that the ovality of the bores must not exceed 0.004 in. As to outside dimensions and length the body is practically standard.

Pipe Dreams of a Tramp Machinist—The Old Way and the New

By Glenn Quharity

I suppose there was once a time when the Brookdell Co. did not exist. The more or less inconsistently arranged group of brick buildings, interspersed with smaller wooden structures, that straggled along both banks of a brawling stream were not always there, but as they were there before I was their beginning was to me a sort of vague detached fancy—like speculating about the origin of the world.

The "old man," too, whom I remember as a pleasant-faced, white-whiskered old chap of somewhat portly



"Kept Books on a Shingle"

appearance and a rather peremptory manner of speaking, had not always been an old man; time was when he was just "Brooks the machinist" in the little seven by nine wooden shop with a big wooden waterwheel on the end of it that stood by the dam.

Brooks started in business with a capital of one forge and accessories, one lathe (*not* a geared-head lathe with quick-change gears, graduated compound rest and taper attachment), one drill press that was bolted to a post and went with a crank, and a grindstone. He also possessed other collateral, such as sundry chunks of iron, some old pulleys and odd pieces of belt, and a healthy determination to make a good living for himself, Mrs. Brooks and the little Brooklets.

How well he succeeded is attested by the prosperous appearance of Brooks' shop—now the Brookdell Co.; the subdued and contented hum of activity proceeding from them; the comfortable, if not particularly commodious, offices with their personnel of bookkeepers and clerks going about their respective duties with a quiet but intense demeanor that seemed to say "Business first—pleasures afterward."

In the shops the neat and orderly array of machinery presided over by cheerful and contented-looking operatives further testified not only to the business acumen of the old man, but to the executive ability of those upon whose shoulders the mantle of his authority had fallen.

In the old days, long before my time, Brooks had an office—under his hat. When business became more pressing and voluminous he kept books on a shingle. By and by, when the accumulation of shingles brought about the dire possibility of some of his live accounts being used to kindle the fire in the old box stove, he graduated to real books, "kept" by Mrs. Brooks.

In later years, when the elder of the before-mentioned little Brooklets occupied the seat of power in the manager's office, and a still later "Rivulet" sat on a high stool before the bookkeepers' desk; when the "system" had grown to keep pace with the requirements of the business (there were "business requirements" even as long as 30 years ago), the old man had ceased to be a power in anybody's estimation save his own.

One day I was in the office repacking a radiator valve (water is now but a small part of the motive power), while the old man and one of his business contemporaries were having a chat about old times. Suddenly the visitor recollected the primary object

"He Scratched His Ear"

of his visit: "Hiram," says he, "I reckon I owe you a small bill and if you'll tell me how much 'tis, I'll pay you."

The old man rose ponderously, reached down a huge ledger from the rack and, seating himself with the book on his knees, began turning the pages slowly one by one until toward the middle of the book he found the name he sought.

He scrutinized the account closely, first one column and then the other, readjusted the glasses on his nose, tilted his head to get a different angle of vision, and finally scratched his ear meditatively. "Henry," he said solemnly, "here's the amount all right, but I'm hanged if I know whether you owe it to me or I owe it to you."

"Oh, it's on me right enough," replied Henry as he handed over the money. The old man carried the book to the desk, duly made out a receipt, and then proceeded to make an entry on the page of the ledger. This finished, he closed the book and replaced it with a sigh of satisfaction, and linking his arm in Henry's the two old codgers ambled out to find other sources of interest.

The head bookkeeper, who had been out of the office at first but had returned in time to get the drift of what had transpired, took down the ledger, opened to the page and was confronted with this entry in the old man's stiff, angular chirography:

"This acc't paid. Double-entry bookkeeping in this establishment is this day *closed*, by G—d."

Preparing Industry for Reconstruction Demands

By C. T. CLAYTON
Director, U. S. Training Service, U. S. Department of Labor

To help the great majority of workers in industrial plants in this country, the U. S. Training Service installed training departments in many American plants. The author tells how ten million people employed in the manufacturing industry can be trained to give better service to their employers if handled by efficient instructors.

THE U. S. Training Service, through its representatives of ripe experience in various industries, and through its clearing house of information at Washington, is prompting industrial training in manufacturing plants in many parts of the country. The work that this service is doing is founded on a simple principle which has been more widely recognized in European than in American industry, namely, that each worker should be taught the best method of performing his task. That industrial training of the sort which the service is promoting will immensely benefit American industry and make it better able to meet reconstruction problems, is abundantly proved by unsolicited testimony from far-sighted manufacturers, in many parts of the country.

This training service especially advocates the establishment of training departments in every industrial plant having 250 or more employees. There are 6000 such plants in this country. When a concern is ready to install a training department, the U. S. Training Service sends its men, who are experienced in shop production, to carefully study the methods in the shop, after which they outline a short systematic training course for teaching the best way to perform the various operations employed there.

A few large concerns have seen the advantage of such training for some time. It has been one of the foundation stones of their financial success and of the prosperity and the contentment of their workers. But these concerns are a mere handful compared with the thousands that have not followed any efficient method of instruction for employees.

The training department in a factory accomplishes two things: It makes beginners efficient in the shortest possible time; and second, it upgrades the mediocre and poor workers in a plant so that they become more productive. The second function is the greater of the two. Fortunately, theories and generalization need not be relied upon in discussing present industrial inefficiency. Production engineers and efficiency experts have compiled a mass of data showing that the average industrial worker is less than 50 per cent. as productive as he would be, if properly trained. Some place the figure below 35 per cent. The employee expends his energy, puts in his time, and uses his employer's machinery and material, without producing so much as half of what he fairly could produce, if he knew how to do it. This is not saying that he is indolent or that he is unwilling to work (it has been shown that only a small percentage of inefficiency is the result of slacking) but the great mass of America's ten million shop and factory workers today are going through life burdened by ignorance of how to perform their respective tasks in the best and easiest way.

Again and again surveys of plants have proved this. Most of the causes, such as failure of power in plants, delay in supplying materials to the workers, incomplete instructions, etc., can also be remedied by the employer independently of his workers, but the great cause, the chief source of this tremendous economic loss, which is confronting American factories when they are seeking to gather all their strength to meet new competition at home and abroad, is the fact that the workers have never been taught how to do their respective tasks in the one best way.

The U. S. Training Service helps establish systematic training, and the expert information it furnishes for guidance points to the one best way to perform each of the jobs and operations in the plant. Many a plant has absolutely no experience or data to resort to when it

comes to running a training department. But the service does not believe in making "specialists" when by that word is meant persons who have been required to concentrate, each on a single, relatively simple task to the exclusion of development in other lines. There are few concerns in which such mere process workers are really as profitable as men more thoroughly equipped. Its training is purposed to broaden each man so that he can be equally useful in a number of places.

The philosophy and the psychology underlying the service are absolutely sound. Every reader can recall more than one task which in earlier years he was told to do but not told how to do. The writer, for one, learned to do certain manual tasks the wrong way and has suffered from curtailed efficiency with respect to those tasks all through the years that have followed. Typewriting illustrates the point. A man pounds out the letters with the first two fingers of his hands. His stenographer in the next room writes twice as fast because she was taught the one right way; the way that years of past experience among the best typewriter users proved was the best way; the way that the writer could have learned in two days if there had been someone there to teach him.

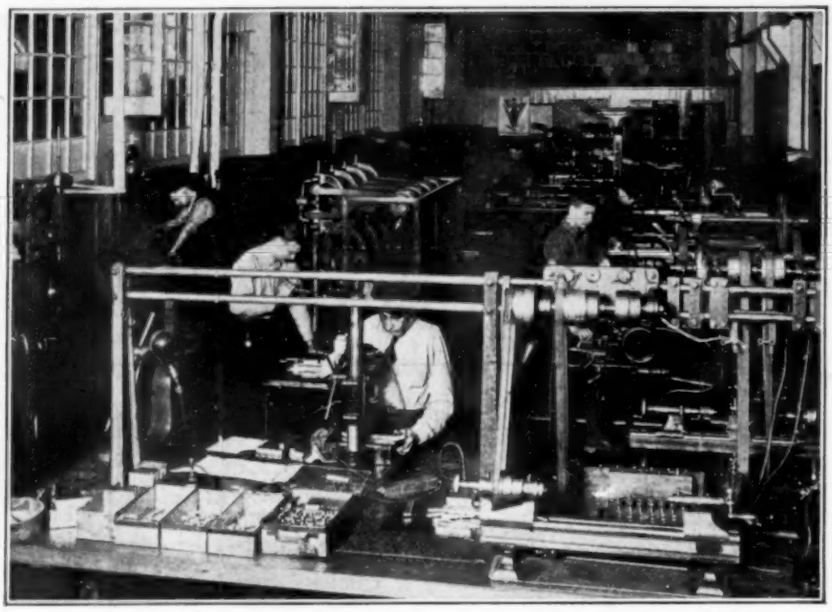


FIG. 1. THIS AND THE ACCOMPANYING ILLUSTRATION SHOW THE MACHINE SHOP TRAINING ROOM OF THE GENERAL ELECTRIC CO., FORT WAYNE, IND.

It is exactly the same with tens of thousands of workers. They are running milling machines, screw machines, punch presses, drilling machines, lathes, and day after day they are making false moves, they are doing things in the hardest ways instead of the best, easiest and quickest ways, all because no one has taught them. It is not meant to give the impression that the employees get no instruction from foreman, sub-foreman and others for, of course, they do get instruction of a sort. But, speaking generally, it is not properly planned if planned at all, and is not planned in a way that the worker can readily grasp and quickly become a normal producer. Too often accident and the ingenuity of the workers are relied upon to get results. The average foreman is too busy with other matters to give real instruction.

Let the reader imagine that he is taking a position in a big manufacturing plant. Under the practice commonly in vogue he is ushered into a big shop roaring with the noise of many machines, at each of which is a worker who eyes the self-conscious new employee curiously. The "green" hand is taken to the machine he is to operate and the foreman or sub-foreman shouts a few words of explanation and instruction, very probably using terms that the worker has never heard before. The novice may be so fortunate as to be shown a few times how to perform his task or perhaps a man is appointed to work with him an hour or a day, depending on the skill of the newcomer and the nature of his job. In any event the plant and worker alike are suffering from a method which has cursed industry in this country since the establishment of our factory system.

But there is another and better way to induct a beginner into a plant. It consists in teaching him carefully and scientifically, and in a separate room if possible. This applies not only to beginners but to any employee who is not doing his work in the best, most efficient way, or who is being transferred to a machine with which he is not familiar. It is a question of skillful instruction. Teaching is a science which we are just beginning to learn should not be confined to school rooms and to books. It should be brought into play whenever information and skill are to be imparted to human hands and brains. There is a best way to run a lathe and that best way should be taught with just as much skill as a trained instructor teaches a geography lesson. The quicker American industry recognizes that fact, the quicker will it meet the opportunities and solve the problems of these reconstruction days, and the sooner will we enlarge that body of American workmen who are contented because they are fully competent, prospering and progressing. By such training we will build up the constituency of skilled, broadly trained workers until they constitute a vast majority of this country's ten million manufacturing employees.

It is seldom that we are converted to the whole of a new idea at once. The idea of industrial training departments in factories has not yet found full acceptance. Aside from the handful of far-sighted firms already mentioned, American industry, generally speaking, has but begun to learn the value of training. The war taught manufacturers the first part of a great lesson, but it was only a start. Many a firm having learned half the truth assumed that it had learned it all. "Yes, we must have a training department," they said. "There are a lot of our regular men who have gone to war. We must use older and younger men and also women. These know nothing about our machines. We must train them so they can take the places of regular workers." This war-time experience opened the eyes of many a manufacturer to the fact that for years previous he had been "breaking in" new workers when he should have given them careful training in a special training department.

But some of the firms having, as has been said, learned half the lesson, have thought that nothing more was needed. They have made the great mistake of assuming that once conditions returned to normal the need of training departments would lessen or pass entirely. They forget that there are three groups to train: First, those entering industry for the first time, usually but about 5 per cent. of the whole; second, those just arriving in a given plant but already more or less experienced; and third, the poor, and mediocre workers who have been regularly employed in the plant. It is the second and third group who constitute the great mass of workers needing training. For them a training department should be a permanent feature so that at suitable intervals they can be upgraded not in one operation only, but in several operations. Only in this way can an employer build up a force of broadly trained men. The day when he can rely on importation of skilled labor from Europe probably is past forever. Almost every plant has a few valuable men whom experience has made expert in several operations. With a proper training department, little difficulty would be experienced in obtaining any required number of men for the force.

FIG. 2. THE TRAINING AT THIS PLANT HAS BEEN UNDER THE SUPERVISION OF E. A. BARNES, THE WORKS SUPERINTENDENT, WHO IS ALSO A SPECIAL REPRESENTATIVE OF THE UNITED STATES TRAINING SERVICE

The training department's biggest function, therefore, is to help this great majority of mediocre and poor workers now dangerously near the "firing line"—I mean dangerously near being "fired"—to be better workers. This is the thing the U. S. Training Service is urging. This is the second half of the lesson which some forward-looking firms of this country already have learned and which all industries must learn if they are to meet competition at home and abroad.

A training department's work for beginners and for upgrading can be done either in a separate room or in the shop proper, preferably the former. But in either case the teaching is done, not by the busy foreman, who may be entirely without teaching ability, but by instructors chosen for the purpose. These are generally the efficient, intelligent operators in the various departments who, by test, display a knack for teaching. However, they are not allowed to rely on their knack alone. For each process or operation taught, the instructor is furnished with a set of carefully worked out directions supplied by the director of the training department. In a large plant the director is employed especially for the purpose, while in a small plant he may be a man who has charge of the training department in addition to other duties.

The U. S. Training Service through its experts and aided by the wealth of information which is available in its Washington clearing house, helps each shop analyze its processes and operations, suggests ways for organizing a training department, and supplies, when it is desired, instruction sheets for the use of the teaching staff.

The service has abundant evidence of the benefits of training for both workers and employers. For example, Ben Schaube a few months ago was running a drilling machine in a New England shop in which there was practically no chance for advancement. He was married, had a wife and two children and, being thrifty, he was able to save a little each week. But there appeared no prospect of betterment until he learned that a neighboring factory planned the installation of a training system. Though it meant an impairment of his wages at the start, Schaube determined to take the training. He began July 1 of last year and showed ability from the outset. In a month's time he was transferred to production work on a large gun-boring lathe. Noticing his ability, the foreman gave him a chance to work on every other type of lathe in the department, an arrangement directly in accord with the spirit of the training department in the plant. When the time came to add a night shift to the factory's force, Schaube, though he had only a few months' experience, was selected foreman. His short experience in the training department and in the shop itself had placed him in work promising a steady advancement. He had benefited himself, his firm and his community. In practically every firm which has given training a fair trial—and today there are approximately 280 such firms—there are many employees who, like Schaube, have profited by it by enhancing the value of their services to their employer.

Among executives of manufacturing plants approval of training is equally emphatic. "While the advantages of training departments can be recited briefly and in a few words, yet in effect they are far reaching and powerful," declares the representative of a large tool company. "In view of this fact it is easy to see that the training department accomplishes one thing alone which indorses it as a success; namely, that it gives the graduate a foundation in the knowledge of machine-shop practice upon which to build when he becomes a working unit in the regular productive force. We have found the close personal contact between the student and the instructor to be one of the primary

advantages of the school, because it gives the instructor an opportunity to study the characteristics and inclinations of the student, and to determine the kind of work which best suits him."

From an adding machine company comes this commendation: "While we have been satisfied with the results attained under the present system of training unskilled help (that instituted during the war), we acknowledge that greater results could be more quickly attained were it possible for us to spare the space to provide for a fully equipped school, in which the employees could be trained directly for the class of work we would employ them in. We know that under such a system, away from the noise and confusion of the big workrooms, and under the guidance of a skilled operator with the teaching faculty, we could more rapidly acquaint them with their duties and instill into them a confidence needed in efficient production. We plan to have such a school when additions to our plant are complete."

Another employer of hundreds of men who is most enthusiastic about training writes: "This systematic training may appear to be an expensive enterprise in which only a few concerns can afford to embark." This is by no means the case. Our statisticians have shown us that it costs from $25 to $100 to hire each employee. If, therefore, this system of scientific training enables us to cut our turnover in two, or even reduce it by one-quarter, the amount saved would be unbelievable.

America stands at the beginning of a new day. Her industries can never return to the wasteful methods of pre-war times. Having been taught in a great emergency that production can be placed on a more efficient basis, manufacturers are not going to rest until they have adapted that great war lesson to peace-time production. They are going to cease relying on Europe for skilled workers and by systematic training will build up bodies of employees who will be broadly capable; men and women who will be more satisfied with themselves and their jobs because they have the consciousness that they are efficient; because they have been taught to do their respective tasks in the best way. With such workers constituting the majority, instead of the minority, of this country's ten million industrial workers, America can face the future confident of her preëminence in the markets of the world.

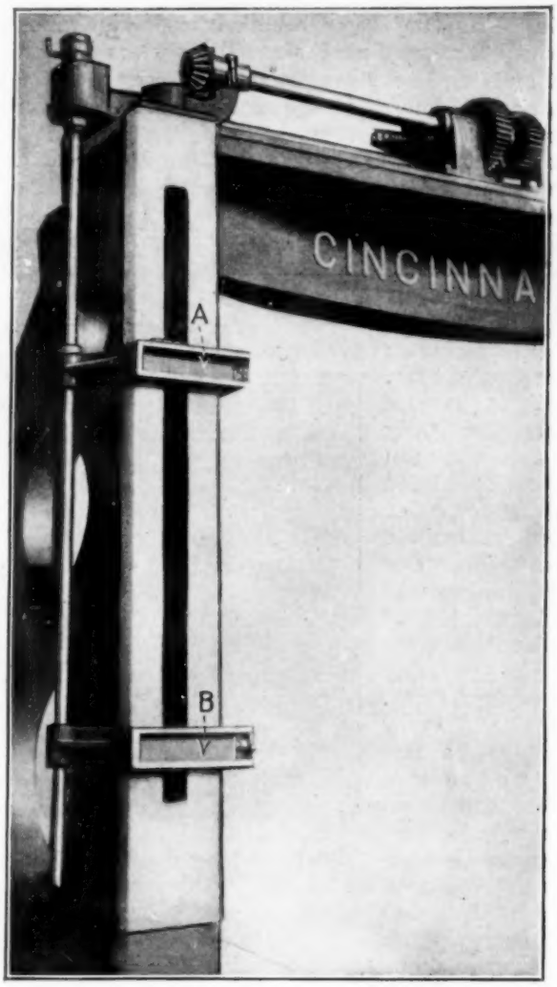
Aligning Brackets for a Vertical Feed-Shaft

By Phil D. Carr

An easy and accurate method of aligning vertical feed-shafts is used in the shops of the Cincinnati Planer Co., Cincinnati, Ohio, for work in connection with the assembly of their boring mills. This method uses the brackets *A* and *B*, shown in the accompanying illustration. They are made to fit the housing face and are provided with the hand clamps seen to the right of each, which clamp down on the edge of the housing.

The arms of these brackets extend toward the rear and have been bored and bushed at the correct distance for the position of the feed-shaft. After placing these brackets, the vertical feed-shaft is pushed through and held in position by the bushings, while the feed-box at the bottom of the housing and the rapid-power traverse miter-gear bearing on the top are aligned to fit the shaft. Dowel holes are drilled to secure their relative positions.

These bearing boxes must be located accurately, for the vertical feed-shaft has a bearing on the back of the rail, and any inaccuracy would cause this shaft



SHAFT-ALIGNING BRACKETS ON BORING-MILL HOUSING

to bind as the rail is raised or lowered. All Cincinnati boring mills are made so that each head has an independent feed, and similar vertical feed-shaft brackets must be aligned on the other housing. This is easily accomplished, using these fixtures on either the right- or left-hand housing.

A Cutting-Off Tool Kink

By A. R. Durant

Recently I had to cut off a number of annular pieces from a bar of tough steel, and had to use the usual form of inserted-blade cutting-off tool. I expected trouble and was not disappointed.

Because of the necessarily long overhang the tool would gouge and chatter, and eventually snag and throw the work out of true, which would either throw off the lathe belt or break the tool.

After trying every conceivable way of grinding the tool without mitigating the trouble, I finally put a small jackscrew under the tool, resting it on the extended part of the cross-slide. This remedied the difficulty at once.

American Motor Vehicles in Foreign Markets*

THE development of foreign markets for passenger automobiles, motor trucks and tractors made in the United States is a subject of immediate importance. Each of its many phases is worthy of intensive study by the exporter, whether he is interested in a single market or in many markets, whether his concern is with one or all of the automotive lines.

Such potential markets are scattered broadcast over the world. It is doubtful whether there will ever occur again an opportunity like the present to enter and consolidate these markets for all time.

Less than 10 per cent. of the 2,500,000 miles of roads in the United States are even moderately improved, yet our motor highway facilities are by far the most extensive in the world. Canada has a great and constantly widening system of good roads. England, France, Germany, Belgium, Holland, Switzerland, Denmark, and parts of Italy and Austria are also splendidly served in this respect, but here we have the beginning and the end of the tale of the markets which have absorbed 98 per cent. of all the passenger and commercial vehicles yet produced. There is a motor vehicle registered in the United States for every 24 persons; in Canada the proportion is probably one to each 50; in England one to 200; in Denmark one to 300; in France one to 400, and in Belgium, Holland, Switzerland, and Germany a proportion not much lower.

Of all the factors governing the sale of motor vehicles, no other is so important as the fundamental one of need. We do not look for shipping where there is no water—we can expect few motors where there are no good roads. Locate the good-road centers of the world and we have found the motor-vehicle markets of the present; determine where road development will make the most rapid strides and we have the potential markets of the future—up to the very limit of the purchasing power of the population served. Good roads without automobiles are unthinkable—one invariably brings the other. The Yokohama-Tokio highway is to cost more than $4,000,000—a mileage cost seldom equaled outside of railroad construction. Governments of other countries are contemplating the building of new roads and the reconstruction of old ones on an unprecedented scale.

It is significant to note how the proportion falls in sections of Europe less favored with this same vital necessity—good roads. In 1917 it was estimated that Italy supported one car to each 1000 of the population, Portugal, to each 1690; Spain, to each 1900; Austria-Hungary, to each 2650, and Russia, to each 5000. In Australasia there was said to be a car for each 140 of population, and in South America as a whole, one for each 1430. Many a minor city in the United States supports more cars than the whole of China or Japan with their teeming millions.

Military Roads Help

Here and there about the world, outside of the few road-favored countries, important cities are well paved, and even linked up occasionally with other nearby centers by fair roads. Elsewhere, as in Japan, limited military roads have helped to open the country to motor traffic. Finally, natural conditions may even permit light cars to find a limited sphere of usefulness in advance of the roads, as on the great level pampas of Argentina. And yet taken all together the improved roads of these far-flung markets of the future probably do not exceed those of some of our single states. In view of this situation it may not appear remarkable that in several of these same states more motor vehicles are registered than exist today in the entire world outside of North America and a fraction of Europe.

Many of the principal belligerent nations have been forced to neglect their normal road-improvement programs during recent years, and to confine themselves to work of military necessity alone. These are probably the countries in which the greatest road development will take place in the next few years. Bitter experience has shown them the immense national value of such public works. Statesmen are already trying to kill two birds with one stone by inaugurating ambitious road programs to make up for wartime neglect and at the same time provide work for demobilized war workers.

It is estimated that more than $540,000,000 will be spent in the United States during the next three years in road improvement. In England $50,000,000 has been made available by the government for extraordinary road and bridge construction and betterment in the immediate future. This is in addition to normal local and national expenditures. Similar programs are under way in Canada, Germany, France, Italy and Austria. Governments elsewhere are paying unprecedented attention to this matter, though necessarily on a smaller scale.

The success of the new motor roadway linking Buenos Aires and La Plata, in Argentina, will undoubtedly lead to similar projects in other parts of that republic. Motor travel in Brazil is not to be confined indefinitely to the paved ways of the greater cities; important improvements to connect Rio de Janeiro and Petropolis, Sao Paulo and Santos, Limoeiro and Piracicaba are under way. Road conditions are improving among the great Sao Paulo coffee plantations.

Chile hopes to link up Santiago and Valparaiso; Peru, Chorrillos, Barranco, Miraflores, Magdalena, Callao and La Paula. Venezuela plans a great highway to run east from Caracas through the States of Miranda, Azoategui and Bolivar to the mining region in the interior of Guayana.

Japan intends to expand her military road system to permit greater touring radius and encourage inter-city motor traffic. It is said that the Yokohama-Tokio highway is to cost more than $4,000,000 before it is completed. This indicates a mileage cost seldom equaled, except in railroad construction. The Japanese government has also set aside 4,300,000 yen ($2,150,000) for the construction of the Kobe-Osaka motor highway. In order to defray its share of the necessary expense, the Hyoge Prefecture is considering the establishment of a motor company with service between Kobe and Osaka, the income derived to be applied to construction costs. The scheme is said to have been approved by the home minister.

An address on road conditions in the United States, made by Mr. Samuel Hill before the Tokio chamber of Commerce, seems to have made a deep impression and apparently led to the formation, in January of this year, of the Road Reform Society, which numbers among its members many of the important men of Tokio. The society, whose first president will probably be Baron Shibusaya, has pledged itself to the immediate consideration of road problems, not only in Tokio, but also throughout Japan.

So much, briefly, for the all-important question of roads as it relates to the development of demand for motor vehicles. As for the tractor, familiarity with the history of the automobile industry and its present prospects leads to a clearer conception of the present potentialities of the newer machine. It should not be forgotten that a growing market for motor cars, by broadening the distribution of necessary supplies and repair facilities and by increasing the numbers of native mechanics and operators available, simplifies the selling problems of tractor manufacturers.

The world's principal producers of motor vehicles have

*From bulletins issued by the Guaranty Trust Co. of New York.

been the United States, Italy, France, Great Britain, Germany, Canada and Belgium. Until war conversion restricted its output, a single American corporation was producing annually four times as many cars as all of the manufacturers of the world combined in 1914. The American output of 1,900,000 motor vehicles in 1917 simply dwarfed the total combined foreign production—in quantity, at least.

And yet so large were our domestic requirements that we occupied only a minor place as an exporting nation until the war upset normal supply and demand and placed us at the top of the list. The United States produced some expensive cars and numberless others—and absorbed them; Europe turned out high-quality expensive vehicles—and exported almost as many as she absorbed.

France for many years topped the list of automobile exporting nations, followed by Great Britain, the United States, Italy, Germany and Belgium in changing array. These other nations did not, before the war, interest themselves in quantity production; but they had long and invaluable export experience. The high reputation of their expensive cars for finish and workmanship in foreign markets gives them an important entering wedge when they turn to cheaper models and quantity output.

Quantity Production in France

The automobile industry of all Europe, save Belgium, seems to have prospered exceedingly during the war. The output of luxurious passenger machines ceased abruptly in 1914, to be followed by a period of feverish expansion in plant, and revolution in product and method. Lorries, airplane engines, and tractors for military purposes took the place of passenger cars and were turned out at unprecedented speed under the spur of dire necessity. Neutral and overseas export markets were neglected but not forgotten. The possibilities of quantity production were driven home as never before, and, realizing that the future of the war-burdened nations must rest on the development of export trade, European manufacturers began to plan for the time when the necessity and opportunity should arrive to challenge America at her own game. The sudden signing of the armistice, however, found the majority of European producers figuring on at least another year of war. They were fully engaged on war production under forced draft, and were almost totally unprepared with post-war models.

But now they are beginning to find themselves, and perhaps nothing better exemplifies the new spirit of Europe in this connection than the expressions credited to M. André Citroen in a recent issue of the *Saturday Evening Post*. M. Citroen is one of the most forceful and successful of French manufacturers. When asked what he would do with his immense munitions factories after the war, he replied: "That's all settled. I shall begin to make popular priced automobiles with the same speed of output that I have made shells. . . . After the war the motor, whether in France, England North or South America, must be a tremendous factor both in business life and in agriculture. It will be one of my aims to popularize the motor among the small business men of France and among the farmers. With peace, one Frenchman will have to do the work of two or three, and the automobile will help him to do it. . . . If France cannot absorb all these motor vehicles we will make a market for them in South America and South Africa. Indeed, with half a chance I should be perfectly willing to enter into competition with America in low-priced cars in America."

In this connection it is of interest to note that M. Citroen, who prior to the war was an important producer of automobile gears, and who before the armistice was signed was turning out 50,000 shells a day, will probably be the first French manufacturer to place a post-war automobile on the market. The new car is a medium-priced, four-cylinder machine, weighing approximately 1400 lb., and ranging in price from $1450 to $1960, according to body style. None of the older French automobile manufacturers has been able to turn to peace production with this speed, though several have been able to place post-war models on exhibition. The Citroen company expects to have developed an output of 100 cars a day by the middle of April, 1919.

The spirit of M. Citroen is apparently the spirit of the largest manufacturers of Europe. They have assessed the possibilities and the problems of the present and of the future. They have prospered and increased their plants. They have learned something of quantity production and are anxious to learn more. Their domestic markets have been starved of normal supplies for four years, and they realize that only by revolutionizing their whole scheme of factory practice and production can they hope to meet us on equal terms even at their very doors. Food problems and transport problems during these bitter years have shown them the future of the tractor and the lorry; they have had high-pressure experience in manufacturing both. They no longer look upon the cheap car as an unenviable and peculiarly American product; they realize that although there will always be a market for the luxurious limousine, the light car is the car of the future for all the world. And they are looking beyond the starvation wants of Europe to the great normal-growth markets of the world and preparing to fight us seriously for the lion's share of the new trade.

Vast Accumulations of Trucks

It is probably in trucks and passenger cars that we are to face the keenest competition. From domestic sources and by import the belligerent governments of Europe have accumulated vast fleets of lorries, estimated as high as 200,000 or more. Even a gradual release of this huge accumulation will tend to take the edge off the immediate demand for new vehicles for peace usage. This of course will give added emphasis to the search for motor truck markets in Australasia, Africa, Asia and South America. But the domestic demand for the new passenger vehicles will probably be more insistent, with a constantly expanding call for low-priced machines. The preference for the expensive cars of European make is already strongly established in many foreign markets and the American manufacturer of similar products is certain to feel the effect of the return of the old favorites to his war markets.

The American exporter to France may expect high tariffs and taxes on his passenger cars and will probably find that every possible encouragement and protection will be given French manufacturers to meet the new conditions. There are no taxes on motor lorries and the French government may pay a bounty on their operation, especially for vehicles of from two to four tons' capacity. The possibility of Amercian manufacturers erecting plants in France will bear consideration. It is said that French builders of tractors are to receive substantial subsidies and that schools for the training of operators are to be widely established.

Italy's Great Development

The developments in the Italian automobile industry during the war have been particularly important. The salient points may be briefly summarized as follows:

Italy alone among our European Allies has proved herself self-sufficient in the production of motor equipment under the strain of war. While French exports were falling 91 per cent. and English exports 40 per cent. between 1913 and 1916, and their imports were rising enormously, Italian imports fell almost to the vanishing point and exports rose 400 per cent. between 1911 and 1917.

The number of Italian motor companies has increased from 30 in 1913 to over 50 at the present time. Exports, formerly made up largely of passenger cars, are now confined almost exclusively to motor lorries. These have gone in thousands to France and Russia, few being shipped to neutral or overseas markets.

The Fiat Works, employing more than 30,000 hands, is the largest motor plant in Europe. During the war, plant, equipment, and capitalization have grown enormously. Prewar production of touring cars, lorries, and stationary and marine engines has been supplemented by airplanes and several types of airplane engines, artillery tractors, machine tools, steel castings, wagons, etc. The present Fiat production of about 100 cars and lorries a day is to be increased as rapidly as possible to conform with the new trade conditions to be met. Experiments with farm tractors already made are to be followed by their manufacture on a large scale and an aggressive selling campaign.

The Italian government is actively encouraging the use and production of tractors, more than 2000 of which were imported during the war. On Mar. 3, 1917, the Italian Minister of Agriculture authorized a bonus of 30 per cent. to all companies or societies purchasing and operating tractors, with 10 per cent. additional if five or more were operated in a single province. A bonus of 20 per cent. to individual farmers purchasing tractors was likewise authorized.

England's Problem

The English automobile industry faced a difficult situation almost from the declaration of war. Mounting restrictions on output, cargo space, fuel consumption, etc., soon practically ruined, temporarily, normal domestic trade in passenger vehicles, and cut export trade in half. Government orders for lorries, tractors, airplane engines, ambulances, etc., necessitated a complete re-alignment of the industry.

In spite of these war-time handicaps, in spite of the serious labor situation, and the uncertainties of its immediate future, available reports indicate that the industry has prospered and is rapidly readjusting itself to peace conditions. Ambitious plans for regaining and extending export trade and for meeting the accumulated domestic demand are under way. In spite of her importance as an exporter, the English pre-war domestic requirements were met in large part by imports from the Continent and the United States. Now, great efforts are to be made not only to compete aggressively abroad with the cheap, light car of foreign make, but also to control a larger share of the home market.

The "Ford Tendency"

The London *Daily Mail* in a recent issue notes the very evident growth of a "Ford tendency" in England. The popularity of the cycle car and of light, inexpensive machines generally has spread rapidly through all classes of the population. This is due in the first instance, of course, to the shortages and restrictions of the war years. Used cars of all types are bringing high prices in England at present, since it is evident that the English manufacturer has not yet caught his peace-production stride. It is stated, however, that a single English motor factory hopes to supply within 12 months what amounts in numbers to the entire British output of motor cars in 1914. The price of this car is not expected to exceed $600 to $750.

In combating labor shortage and the effects of the submarine blockade, the English government introduced great numbers of farm tractors, and both their use and manufacture is being encouraged in many ways. The trade figures of recent abnormal years are interesting, but in many cases, particularly where the countries most affected by war are concerned, they form a dangerous basis upon which to figure future export campaigns.

As early as 1917 evidence came to hand that the new spirit abroad among European industrial leaders had penetrated to Austria-Hungary. The automobile and airplane manufacturers of Hungary, whose prosperity had been maintained by heavy war orders, formed an organization, as a subdivision of the National Union of Hungarian Manufacturers, to consider the advantages of possible quantity production after the war, and the various questions involved in the demobilization of government cars. The great Austrian Skoda Works (Skodawerke A. G. of Pilsen), and the Waffenfabrik at Styr are said to be maturing plans for the output of great quantities of motor trucks under peace conditions. If that peace brings a certain degree of stability to these regions and relief from the very evident handicaps of the present, the influence of such programs, if persistently developed, may well be felt in the motor vehicle markets of the Near East and through great areas of the old Russian empire. It is needless to say that German manufacturers will make determined efforts to dominate these same markets.

The Japanese Subsidy Plan

Japan, in March, 1918, passed an important Motor Vehicle Subsidy Law designed to encourage domestic manufacture of vehicles suitable for military use, or failing that, to make their importation attractive. Under this law, only such motor vehicles as are (1) built according to the specifications of the appropriate minister of state, (2) used chiefly for the transport of goods, and (3) capable of carrying at least one ton (English), or of being reconstructed accordingly, shall be eligible for subsidies.

A Japanese manufacturer may be granted a subsidy of 1000 yen ($500), for each such motor vehicle produced, and 500 yen ($250) additional if he uses such vehicle himself or permits another to use it. The purchaser of a new vehicle from a manufacturer, upon which a "manufacturing subsidy" has already been paid, may receive a "purchasing subsidy" of 1000 yen. Such a purchaser may also be granted a "maintenance subsidy" not exceeding 300 yen ($150) per annum. Maintenance subsidies shall be restricted to five years from the date of purchasing subsidy, and ten years from the date of manufacturing subsidy.

The building of automobile bodies in Japan has attained very considerable importance, due no doubt to recent difficulties and the unusual popularity of closed types. Under existing restrictions on imports the domestic output has found a considerable market, but here again the question of comparative quality and durability has been raised.

In China the existence of cheap, skilled labor and the demand for special bodies had led to considerable development of the industry in the principal treaty ports, where many of the large automobile dealers maintain such works in connection with their establishments.

Australian Automobile Bodies

It is in Australia, however, that war conditions have given the great impetus to body building. In 1917, automobile bodies were classed as luxuries and their import stopped. A later modification permitting the import of a single body with each three chassis did not materially reduce the incentive to manufacturers in Adelaide, Melbourne, and Sydney to increase their facilities and output. In 1917 the production amounted to 2500 bodies, and plans are maturing for an output of 10,000 in 1919. The local workmanship is said to be excellent and entirely successful in meeting different requirements of the Australian market.

Next to the United States and Canada, Australia probably supports a greater number of motor vehicles in proportion to her population than any other country in the world. It is likely, therefore, that serious effort will be made there to manufacture machines in quantity. One or two small vehicles have already been turned out complete, but reports as to their efficiency vary, and it is unlikely that the import trade will be seriously affected by this factor, for a number of years, at least.

No Discouraging Factor

When all has been said that can be said regarding the export situation as it affects the manufacturers of automotive products, there does not appear one factor to warrant discouragement on the part of the American exporter who is prepared to work steadily, patiently, and intelligently for the long pull. And it is with such exporters, whose vision shows them the developed markets of a decade or two decades hence, rather than the mere profit-and-loss of this year or next, and who are open-mindedly and greatheartedly creating permanent markets founded upon quality, fair play, good will, and service, that our future greatness rests. The present is a time of restrictions, annoyances and handicaps without end—but they need discourage none but the casual exporter, whose interest in foreign trade is measured solely by the state of his domestic market.

Conditions in European equipment and policies are undergoing radical change and it is the part of wisdom to be fully informed on the matter. An era of intensive competition is at hand, and we should recognize and prepare for it. Yet it is impossible to ignore the immense advantages with which nature and circumstances have endowed us.

European motor builders have doubled, trebled, multiplied their plant and equipment 10 times in four years—yet their combined capacity is still the merest fraction of our own. They have made a beginning on quantity production, but

it is only a beginning, and development such as ours does not come in a year or in two years. They have felt the world call for a cheap, light machine, but it will be a long time before we can be seriously challenged in this respect. Peace came so suddenly that in most cases post-war models were not even in process. Many of those on which information has come to hand show the effects of standardization and an effort at lower price, but Europeans still think in terms of cars for the classes rather than for the masses.

The war years have brought us added prestige, unparalleled national prosperity, and valuable export experience. Most of the world needs our automotive apparatus and only here and there has it been barred. The indefinite English embargo against motor vehicles, the French one-year embargo, difficulties of shipping and international finance are only the temporary handicaps of reconstruction. The American motor vehicle manufacturer faces a great opportunity and a great responsibility.

System Versus Foremanship

By Harry Senior

I am glad to note, by the appearance on page 777 of *American Machinist*, of the article entitled "A Machinist's Criticism of Modern Shop Systems," that at least one machinist is sitting up and looking around him, but I am deeply grieved that my powers of description or of logic are so seriously at fault that its author, Mr. Gray, could read my article on page 493 without discovering that my ideas are not at all at variance with his own.

As Mr. Gray mentions me specifically, I venture to assume that he includes me as well as my good friend John R. Godfrey in his generalization of "hammer artists" who are harshly criticising shop systems. Now, speaking for myself, I never "knocked" a shop system in my life. I presume that I *might* do so if I wanted to, but I can't spare the time.

If Mr. Gray will read my article more carefully he will not only discover that I spoke very respectfully of Mr. Taylor and his system, but also that the thing that I criticise is *not* system, but rather a hydra-headed parasite that has attached itself to system, cloaked itself in the verbiage of system, and by unwarrantable misuse of the prestige and "vogue" given to system by Mr. Taylor, has taken advantage of the credulity of some managers and the absorption of others to fatten itself upon business.

Years ago, shortly after I got the kodak craze, while perusing an instruction book on the subject of photography I came upon a very illuminating sentence that has since served me well in many other pursuits. It was this: "Compose your backgrounds to suit your pictures, for the background is going to be there anyway whether you want it or not."

So with shop system; it is going to be there anyway, so it behooves us all to give it proper attention, and make sure that it is a good and suitable system instead of an indifferent or bad one.

A system, like a background, may be carefully composed to suit the business in hand and introduced by those who are concerned solely with its effect on the latter, or it may be ignored and left to intrude itself; in either case it remains but an accessory. It may involve "stop-watches" and "be-collared youths" or not according to its needs, but it still remains a background; a thing upon which the progress of the work is superimposed. On the other hand the fake system is the main thing; something that is introduced for its own sake, and where the work and the conditions do not fit it, it is the work and the conditions that must be hammered into shape.

It would be a waste of time for me to attempt a burlesque upon system; the thing is already being done only too well by those imitation "systems" that are not system. I cannot subscribe to Mr. Gray's opinion that they are founded upon sound logic. It is my belief that they are founded principally upon the desire of the originator to create for himself a soft job; that, taking advantage of the undoubted value of Mr. Taylor's efforts in that direction, the pseudo "engineer," the inefficient "efficiency expert" who is not an expert, has elaborated a heterogeneous mass of detail calculated to fool a busy manager into the belief that his business needs a doctor, and that anyone who can present such a gilt-edged prescription must be the right doctor.

Mr. Gray says that I "come pretty near hitting the nail on the head in so far as enlisting the sympathies of the men is concerned," while in the next paragraph he says that "most systems tend to perplex, discourage, and even to provoke the opposition of the workmen." Can he suggest a better way of finding out and removing the causes of perplexity and opposition than to enlist the sympathies of the men?

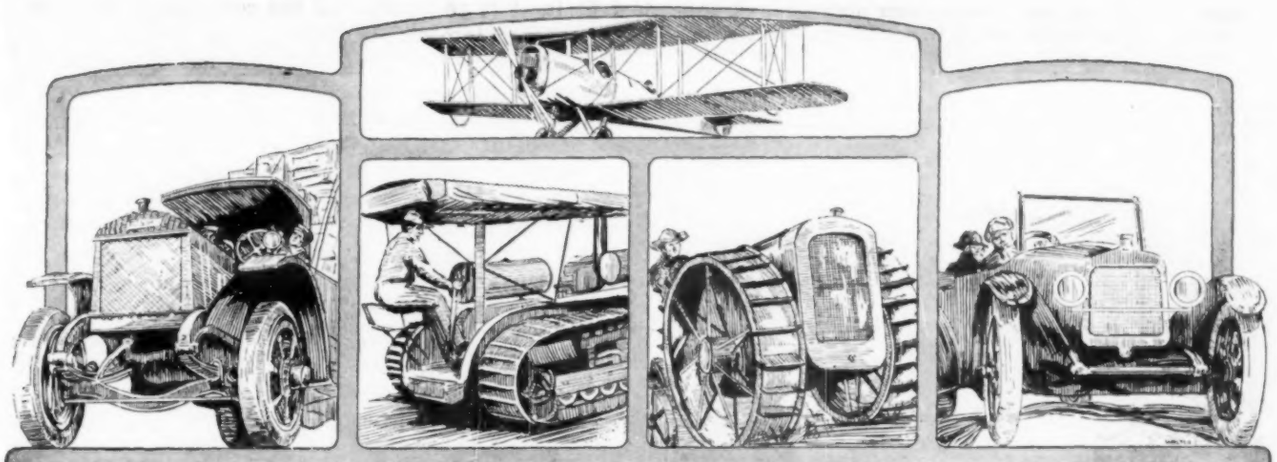
Most of the so-called systems operate, like Mr. Godfrey's "pink-slip" system, to hinder production and interfere with the natural inclination of most men to do their work as well and as quickly as they know how, and one of the most active causes of annoyance and opposition is the tacit assumption by the management that the would-be systematizer knows more about the men's work than the men themselves do.

There *are* men, to be sure, whose inclinations are not in the direction indicated in the foregoing paragraph, but their number is comparatively small, and what they need is not a system but a foreman—which brings me to whatever point there may be in this dissertation.

In order to have a *real* efficiency expert, we must select a man of proper temperament, give him a thorough education in the class of work he is going to handle—make him serve an apprenticeship, so to speak, in the expert business—and then turn him loose with sufficient authority to put through whatever he thinks desirable in the way of system. If he is of the right sort, his system will be just fitted to that particular shop, for it is as impractical to design one system to fit all shops as it would be to design one style of clothes to fit all kinds of men

When we get his education completed we will promptly recognize him as Mr. "Old-Time Foreman," concerning whom so many hot-air artists and verbosity engineers have solemnly declared "he has gone, nevermore to return." We will shake him by the hand and say: "Hello, Mr. Foreman, we're glad to see you back. Please consider yourself our representative in this department. Hire whatever help you need and get the work out. You know what needs to be done better than we do, and while we are always ready to advise with you, the more completely you take over the mechanical problems the better we will like it. We expect to stand or fall by your judgment—that is what we educated you for. If we stand you shall have your reward; if we fall you will probably get fired. So-long."

In regard to Mr. Gray's closing paragraph, Since when has science ceased to be common sense?



AUTOMOTIVE CONSTRUCTION

Assembling Liberty Motor Cylinders

BY H. A. CARHART
Mechanical Engineer, Lincoln Motor Co., Detroit, Mich.

The finishing touches always take more time than we anticipate, and this article shows the final minor operations which are necessary before assembling. The fixtures and testing fixture used in assembling are of interest to all engaged in the manufacturing of accurate products.

AFTER the finish-grinding as previously described, the cylinders come to the assembling department for the final touches and to have the valves, valve springs, etc., put in place ready for the final assembly on the engine base. The final cylinder operations follow:

Stock.
Assembling the elbow.
Tack-welding the elbow.
Welding the elbow.
Butt-welding the elbow.
Bore-welding the flask from the interior of the elbows.
Chip-welding the flask outside.
Water testing.
Assembling the jacket.
Tack-welding the jacket in two places.
Welding the seam and the bottom.
Welding around the top bosses and spark plug.
Welding the elbow parts.
Welding the intake and outlet pipes.
Water testing.
Assembling and tack-welding the flange.
Welding the flange.
Archwelding the flange.
Water testing.
Heat testing.
Inspecting.
Face-turning the pilot.
Finish-reaming.
Rough-milling the exhaust and intake flange.
Drilling, reaming and countersinking the valve-stem guide bushing holes.
Drilling 10 holes in the bolt flange.
Drilling the outstock in the exhaust and intake holes.
Reaming, spotting, countersinking and tapping the spark-plug holes.
Seating the valve seats.
Countersinking the spark-plug holes.
Rough-milling the camshaft housing bosses.
Drilling and tapping the camshaft housing bosses.
Milling four slots in the bolt flange.
Hand tapping the spark-plug holes.
Washing.
Rough-grinding the face of the flange.
Rough-grinding the inside.
Finish-grinding the inside.
Second washing.
Finishing the pilot and flange.
Finish-milling the camshaft housing bosses.
Reaming 10 holes in the flange.
Finish-facing and tapping the bolt flange.
Finish-milling the exhaust and intake flange.
Drilling the exhaust and intake flange.
Countersinking camshaft housing bosses and exhaust and intake holes.
Third washing.
Inspecting.
Putting in the finish stock.

GRINDING OUT THE PORTHOLES.—This operation consists in grinding the inner surface of the intake and exhaust portholes in order to produce a smooth surface that will offer no obstruction to the passage of gases and will not readily accumulate carbon. The cylinder is held in the fixture fastened to a bench as shown in Fig. 1, and is ground with an emery wheel, $\frac{3}{4}$ in. x $2\frac{3}{8}$ in., 60-L, attached to an R. G. Haskins flexible shaft, driven by a $\frac{1}{2}$-hp. induction motor.

REMOVING BURRS FROM THE CYLINDERS.—This consists of removing from the cylinder, all the burrs caused by machine operations and which might injure the hands of the workmen who handle these cylinders, in addition to preventing their proper alignment. The cylinder is held in the same fixture as before, files and scrapers being used for the work.

These burrs are removed from the top and bottom edge of the cylinder flange, the inner and outer edge of the intake and exhaust flanges, the edge of the camshaft housing boss, the spark-plug hole, the inside of the valve chamber, and the $\frac{3}{8}$-in. holes tapped in the intake and exhaust flanges. Every cylinder is inspected after the burring operation to insure all burrs being removed. The production was 150 cylinders in nine hours.

FILING AIR GROOVES IN STUDS.—This consists of filing an air groove on the end of the studs which screw into the cylinder. This groove is filed the entire length of the threads and to a depth greater than that of the threads. The purpose of this is to permit the air to escape as the stud is driven to the bottom of the hole. The production was about 2000 studs in nine hours.

Before inserting these studs, the holes are hand-

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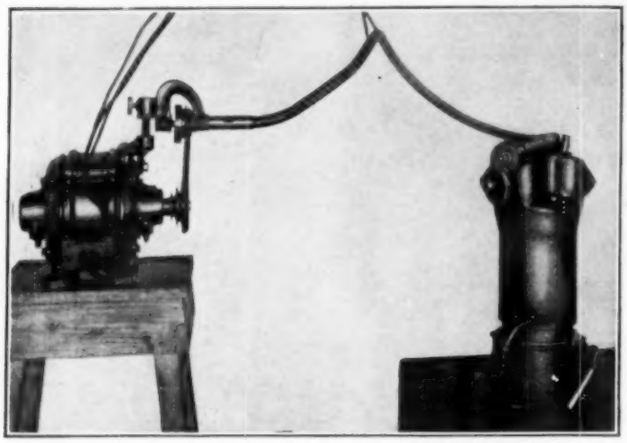

FIG. 1. CLEANING OUT THE PORTHOLES

tapped as follows: Two holes in each intake and exhaust flange are tapped with a $\frac{3}{8}$ in. x 24-in. plug tap, and two holes in the camshaft housing bosses are tapped with a $\frac{5}{16}$ in. x 24-in. plug tap; two studs are then driven to the proper depth in the exhaust flanges, two in the intake flange and one of each kind in the camshaft housing bosses; one of these studs is mounted on the exhaust side and the other on the intake side of the cylinder, to be assembled on the left side of the motor and the order reversed for a cylinder to be assembled on the right side. The studs are driven by stud drivers, tools being used for determining the proper height of the studs in the cylinders. During the foregoing operations, the cylinder is held in the fixture shown in Fig. 1. The production was 110 cylinders in nine hours.

ASSEMBLING THE VALVE-STEM GUIDES.—The cylinder is placed on the fixture attached to the table of a No. 4 Greenerd arbor press. A tool is then inserted in the valve-stem guide hole leading into the exhaust valve chamber, a valve-stem guide is placed over the end of the tool, the tool is inserted in the upper end of the valve-stem guide, and the arbor press forces the valve-stem guide into position. The cylinder is then turned one-half way around on the fixture, and the same operation is repeated in the intake valve-stem guide hole. The production was about 700 cylinders in nine hours.

HAND-REAMING THE VALVE-STEM GUIDES.—The cylinder is placed in a fixture which holds the cylinder horizontally on a bench with the top of the cylinder toward the operator. The valve-stem guides are then sized with suitable reamers, each being fitted in a carpenter's brace. Each reamed hole is then gaged for size. The production was 425 cylinders in nine hours.

CLEARANCES USED IN THE LIBERTY ENGINE

	Minimum	Maximum	Desired
Crankshaft:			
Ford bearing	0.002	0.004	
Diametrical clearance	0.0025	0.00325	
Cheek clearance	0.028	0.060	
End play	0.001	0.004	
Connecting-rods:			
Forked end—			
Ford bearing	0.0025	0.0045	
Diametrical clearance	0.003	0.004	
End play	0.006	0.020	
Plain end—			
Diametrical clearance	0.005	0.0065	
End play	0.004	0.010	
Piston pin:			
Fit in rod	0.00125	0.0025	
Fit in piston	0.0005	0.00075	
	loose	tight	
Piston rings:			Top 0.003 Mid. and
Fit in grooves	0.00125	0.003	Bot. 0.002
Gap	0.021	0.041	0.030
Piston:			
Fit in cylinder	0.018	0.022	Select for 0.020 clearance
Camshaft:			
Diametrical clearance	0.001	0.004	
Diametrical clearance No. 1 bronze	0.005	0.0035	
End play	0.000	0.004	Min. 0.002
Camshaft upper drive shaft:			
Diametrical clearance—			
Large bushing	0.0005	0.0025	Min. 0.0015
Small bushing	0.0005	0.0025	Min. 0.0015
End play	0.001	0.009	Min. 0.004
Rocker levers:			
Diametrical clearance	0.00025	0.00175	Min. 0.001
End play	0.0042	0.0122	0.0075
Valves:			
Fit of stems in guides—			
Diametrical clearance—			
Exhaust valve	0.004	0.0065	0.005
Inlet valve	0.002	0.0045	0.003
Water-pump shaft:			
Diametrical clearance	0.0015	0.0035	Min. 0.0025
End play	0.006	0.020	0.010
Water-pump bevel driver:			
Diametrical clearance	0.001	0.003	
End play	0.005	0.009	
Oil pump:			
Fit of gears in housing—			
Diametrical clearance	0.0025	0.0065	Select for 0.004 clearance
End play	0.002	0.007	Select for 0.003 clearance
Tappet:			
Exhaust valve	0.019	0.021	
Inlet valve	0.013	0.016	
Breaker gap	0.010	0.015	
Spark plug gap	0.013	0.015	0 014
Regulator:			
Contact gap	0.005	0.007	
Height of pin	0.043	0.045	
Backlash crankshaft gears	0.015	0.020	0.0175
Backlash oil-pump gears	0.004	0.006	0.005
Backlash all other gears	0.005	0.010	0.0075

AN INTERESTING DIAL FIXTURE

HAND-FACING THE VALVE SEATS TO THE PROPER DEPTH.—The cylinder is placed in a fixture, Fig. 2, with the open end toward the operator. The cutters are mounted as shown and the pilot or stem of this tool inserted in the lower end of the valve-stem guide. A socket, attached to a carpenter's brace, is inserted in the cylinder bore and brought into contact with the hexagonal nut on the tool. The stem of the tool comes in contact with the indicating dial, seen at the upper end of cylinder. This is mounted in line with the valve-stem guide and indicates when the proper depth has been reached, using the camshaft housing boss as a locating point. During this facing operation, ker-

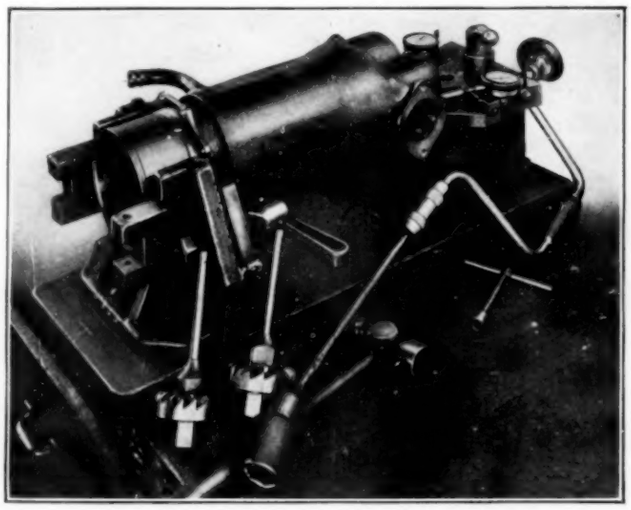

FIG. 2. FACING THE VALVE SEATS

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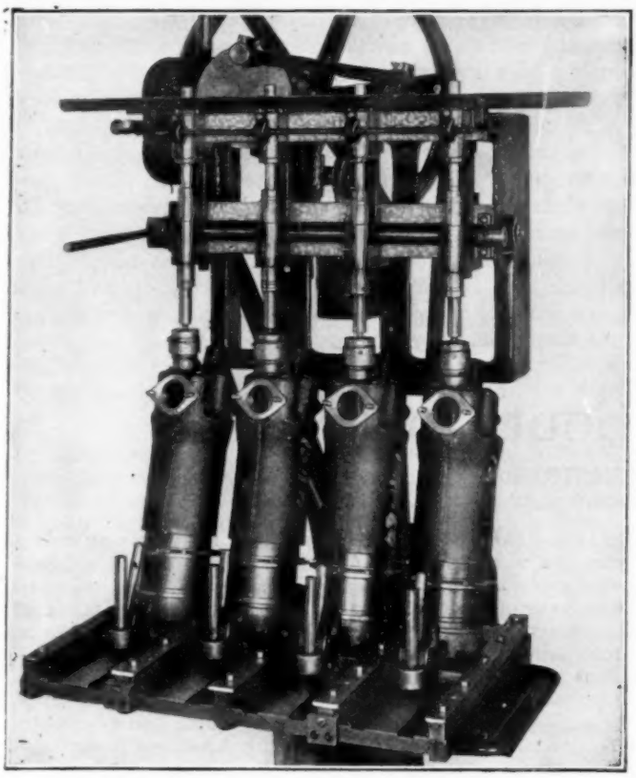


FIG. 3. LAPPING THE VALVES

osene oil is used to facilitate cutting. The same operation is repeated on the exhaust side of the cylinder. The production was about 135 in nine hours.

ASSEMBLING THE VALVES.—The cylinder is placed on a round wooden pilot, which is covered with cloth to avoid scratching the bore, and fits the bore loosely. A smooth place is then filed on the outer edge of the cylinder flange, with a 12-in. half-round bastard file and the proper number stamped thereon with a $\frac{3}{16}$-in. steel metal stamp. The cylinders are numbered from 1 R to 6 R. and from 1 L to 6 L. Valves are marked correspondingly with the addition of "I" for intake, and "E" for exhaust, sides of the cylinder. Before the valves are placed in their respective cylinders for lapping, a lapping compound composed of silex (powdered silicon) and cutting oil is applied to the surface to be lapped.

The valves are then placed in the cylinder, care being exercised to see that the marking on the cylinder flange and the valves agree, and that the valves are properly placed. The valves are then secured in place by adapters and the cylinders placed in groups of four on the fixture, shown in Fig. 3, attached to the table of a Foote-Burt, four-spindle lapping machine. Attached to the spindles of the lapping machines are tools having two projecting pins which engage two holes in the top of the adapters.

With the lapping machines in operation, the valves are rotated with a reciprocating movement in each direction for one and one-half revolutions, the valve being separated from the seat at frequent intervals to allow the compound to flow in between the two surfaces. This lapping operation is continued for four minutes. The cylinder is then turned one-half way around on the fixture, the other valve adapter brought in contact with the tool, and the operation repeated. The cylinder is then removed from the lapping machine, placed on a bench, the adapters removed, and the valve seat inspected to insure having an unbroken lapped surface of the proper width.

The production of a four-man gang is 650 cylinders in nine hours.

WASHING THE VALVES AND CYLINDERS.—The valves are removed from the cylinders and washed in kerosene. For washing cylinders, a galvanized-iron tank, 2 ft. 6 in. wide, 2 ft. 10 in. deep and 8 ft. long is used. A wooden rack is mounted inside the tank, with projecting strips about 4 in. below the top of the tank on which the cylinder is supported by the flange, in an inverted position. The water in the tank is heated and mixed with washing soda, and is pumped into the cylinder through a $\frac{3}{4}$-in. hose, thus removing the oil and compound deposited during the lapping operation. A two-man gang handled 700 cylinders in nine hours.

ASSEMBLING THE VALVE SPRING.—The cylinder is placed on the special press, shown in Fig. 4, a wooden pilot of the press holding the intake valve in the proper position. The cylinder is positioned by a flange-bolt hole as shown. The lower collar, the two springs and the upper collar are placed in position. The press-foot lever is then operated, compressing the springs so that the two half-circular keys can be placed in position. These engage the grooves in the upper end of valve stem and lock the springs in position. The cylinder is then turned one-half way around and the operation repeated on the exhaust valve. The production was 700 cylinders in nine hours.

INSPECTING VALVE SEATS FOR LEAKS.—The plugs are placed in the spark-plug holes and the cylinder placed on a wooden rack in an inverted position, supported from the flange. Sufficient kerosene to cover the

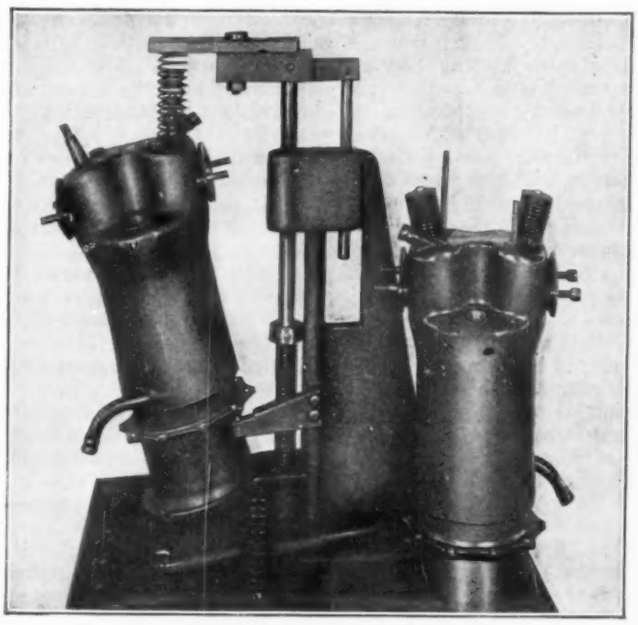


FIG. 4. PUTTING ON THE VALVE SPRINGS

AUTOMOTIVE CONSTRUCTION

valves is poured into the cylinder and air pressure applied to the valve seats through each port. At the same time the air pressure is applied, the inspector watches the kerosene and if bubbles appear the cylinder is rejected as being defective. The percentage of leaks in this test varies between 2 and 10 per cent.

INSPECTING THE VALVE SEATS FOR PROPER HEIGHT.—The cylinder is next inspected for proper height of the valve stem by being placed in a fixture which has two indicating dials arranged in line with the two valve stems. When the cylinder is securely clamped in this fixture and the head on which the indicating dials are mounted is in contact with the camshaft housing boss, an accurate reading as to the height of the valve stems, is shown. The top of the camshaft housing boss is used as a locating point in adjusting these indicating dials.

The cylinder is now inspected for proper location of the valves, alignment and location of all studs, and the condition of water pipes, after which, blind gaskets stamped with number and letter corresponding to such marking on the cylinder flange are placed over the exhaust port and secured by two brass nuts. The cylinder bore is then oiled with rustproof oil and goes to the paint shop where it receives two coats of paint. It is then ready for the engine assembly.

Direct Selling in South America*

BY P. S. STEENSTRUP
General Manager, General Motors Export Co.

South America is one of the world's greatest potential markets. Its resources are enormous. With an area of 7,352,766 square miles, more than twice the area of Continental United States, including Alaska, its population is only a little more than 50,000,000, or about half that of our country. Its wide stretches of farming and grazing lands, its enormous undeveloped mineral resources, its great virgin forests, offer wonderful opportunities for the tax-ridden people of Europe to find wealth and happiness.

BEFORE attempting to market a product in South America, a careful and intensive study of the markets and trade conditions should be made. Most products marketable in the United States can be sold in South America, but the area is so large, and trade conditions so varied, that a very careful study of conditions should be made before a selling campaign is launched.

For the manufacturer with ample capital and a staple product for which a large and sustained demand can be created, the branch house is the best selling method to employ in developing South American markets. The establishment of a branch house makes your business a part of the country and community, and gives you a standing which cannot be obtained by other methods.

If market possibilities or finances do not justify the expenses and risks incident to the establishment of branch houses, the next best way to market your product in South America is through traveling salesmen and exclusive representatives.

Great care should be taken in selecting your traveling representatives. Although good men are scarce, traveling is so expensive that you cannot afford any other kind. An unsuitable traveler is a very costly investment. Men developed in your own office will probably be found most satisfactory. They should know your product thoroughly, should have a good conversational knowledge of Spanish and Portuguese, or Spanish and French, and be dependable and adaptable. Personality and breeding are important in the South American field.

Many American merchants and manufacturers whose salesmen have never been south of the Rio Grande have built up substantial and profitable trade relations with South America. The larger mail order houses are doing a large volume of business in this territory, and many of the larger New York department stores are receiving orders from the wealthy South Americans. Our export publications are now carrying advertisements of practically all known commodities from pins to locomotives and many of the advertisers never have had traveling representatives in South America.

For the merchant or manufacturer who does not wish to incur the expense of sending out traveling representatives, the mails offer a comparatively inexpensive and frequently effective medium for developing South American trade. Advertisements in our export publications bring good results; and if desired, this form of advertising may be supplemented by circularizing lists of prospects which may be obtained from Daily Commerce Reports, Foreign Trade Directories, Business Associations, Banks with South American branches, United States Consuls, and the companies which furnish lists of various kinds. Advertising matter for use in a direct-by-mail campaign of this kind should be prepared with the greatest care. Catalogs and circulars should be well illustrated, printed in idiomatic Spanish, or in Portuguese if for distribution in Brazil, and when prices are quoted they should be in the money of the country in which the literature is distributed. All inquiries should receive prompt and careful attention, and replies should be in the language of the correspondent.

Before exclusive agencies are granted, a most thorough investigation of the prospects and possibilities of the territory which the agent proposes to cover, should be made. Sometimes a merchant handling competitive lines, manufactured in European countries, places a small order with an American manufacturer for the sole purpose of obtaining an exclusive contract and excluding the product from the market during the life of the agreement.

The merchants of South America may be grouped in five classes: (1) The general importers who correspond to the wholesale jobbers in this country; (2) large retailers who import for their own account; (3) large land owners or development companies who import; (4) the small shops and retailers in the cities; and (5) the general stores, usually found in the rural districts and mining camps and corresponding to the general stores in this country.

As a rule, the South American prefers a small turnover and a large profit. He conducts his business in what to us seems a very leisurely manner. The shops in the cities usually open at 8:30 or 9 o'clock, remain open until noon, and then close until three. The most popular shopping hours are from three to six, at which hour most of the city stores close.

The business men, as a rule, are conservative, and shrewd, careful buyers. They are well educated, polite and hospitable, with a high regard for music, literature and the fine arts. The South American likes to become thoroughly

*From an address delivered at the Sixth National Foreign Trade Convention, Chicago, Ill., April 25, 1919.

acquainted with you before he talks business, and in the smaller cities it is advisable to visit your prospect two or three times before your business is even mentioned. Appointments are quite frequently neglected and you will find it desirable to give your prospect plenty of time to make up his mind because, while he is at all times courteous and hospitable, he greatly resents being hurried or persuaded against his will.

Holidays are numerous in South America and these and the customs of the country should be strictly observed. If you happen to pass one of the religious processions which are very common and your native companion doffs his hat, you should do likewise if you wish to avoid giving offense. If you meet your merchant friend on the street, he will remove his hat and shake your hand in greeting. It is a breach of courtesy not to reciprocate in a like manner. When entering a merchant's place of business, courtesy demands that you uncover and remain so until you depart. In your correspondence be thorough and polite. The Spanish language is full of complimentary words and phrases, and you are not taking full advantage of your opportunities if you fail to use these in liberal quantities in your letters.

Methods of Packing

When you receive an order from South America in which definite instructions are given regarding packing, marking and shipping, follow them explicitly. Much of the dissatisfaction with our merchants and products in the past has been caused by failure to follow packing and shipping instructions.

A great amount of the inland freight in South America is moved by animal transport; mules, oxen, llamas and burros are employed, and much of the travel is over rough mountain trails. The average load for these animals is: 100 lb. for llamas; 150 lb. for burros; and 200 lb. for mules. When your customer specifies that his goods are to be packed in cases made of 1-in. lumber and measuring not over 2 x 3 ft., there is a good reason for his doing so.

On the West Coast of South America, good ports are few and most ships are unloaded in the open roadsteads. The merchandise is discharged on lighters. Packages are lowered on to the lighters by the steamer crane, usually very carelessly. If the lighter is wallowing in a heavy ground swell, the load often strikes with a terrific impact. The necessity for secure packing in strong cases is therefore apparent.

The moisture, heavy rains and excessive heat should also be considered in preparing shipments, especially if the packages contain perishable articles. The best protection against moisture is a zinc or tin-lined case. Machinery and metal parts should be coated with oil to prevent rust. Pilfering is common in South America, and every effort should be made to make up the packages in such a way as to guard against this. When the packages are transported over numerous routes it is impossible to fix the responsibility for the theft, and there is slight possibility of recovery.

In making up shipments, the tariff classifications of the different countries should be considered. Do not pack in one case different classes of merchandise on which duty is assessed at different rates, as the duty is then assessed on the entire shipment at the highest rate.

Marks on cases should be simple, plain and legible; stencil marking is the best. Some South American countries prohibit receipt of shipments unless marked with stencils. The net, gross and tare weights should be plainly marked on each case, and when the shipment contains two or more cases, they should be numbered consecutively.

Credit Required

The South American merchant requires credit for a number of good reasons. The resources of the country are, and will for some time remain, largely agricultural, and although the crops vary in the different countries, the merchants are called on to finance the native farmers; the same as our general merchants in the smaller towns. Bills are not paid until the crops are sold, and the merchant requires credit until he receives his money. Duty must be paid on practically all merchandise imported, and duty and ocean freight amount to 25 to 75 per cent. of the value of the goods. Stocks move slowly, and the merchants are required to carry large stocks on hand to take care of demand between shipments. Financing of some kind is essential, and as interest rates are high in South America, the merchant usually prefers to buy where he can obtain credit terms at reasonable rates of interest rather than borrow money locally.

South American merchants are, as a rule, reliable and trustworthy, and their code of honor is as rigid as that of our most reliable business men; but frauds are occasionally practiced and a thorough investigation should be made before credit is granted. Credit reports may be obtained from commercial agencies, American Consuls or from banks maintaining foreign branches. Branches of the following American banks are now doing business in South America:

The National City bank of New York maintains branches at Buenos Aires, Rio de Janeiro, Santos and Sao Paulo in Brazil; Santiago and Valparaiso in Chile; Montevideo, Uruguay and Caracas in Venezuela. A branch in Buenos Aires is maintained by the First National Bank of Boston, while the American Foreign Banking Corporation has a branch at Rio de Janeiro. The following South American Banks are affiliated with the Federal Reserve Board; Banco Mercantile Americano de Colombia-Bogota, Barranquilla, Cartagena, Madellin, Manizales, Girardot, Cali, Honda; Banco Mercantil Americano del Peru-Lima, Arequipa, Chiclayo, Callao; Banco Mercantil Americano de Caracas-Caracas and La-Guayra, Venezuela; American Mercantile Bank of Brazil-Para, Pernambuco.

Advertising

Advertising is in its infancy in South America. The periodicals are limited in number, rather poorly printed and generally of small circulation. The greatest obstacle to large circulations is the great amount of illiteracy among the natives. The most popular magazine in South America, published in Argentina, has a circulation of less than 145,000.

But, just because advertising is not so common in these countries as it is here, the opportunities for profitable advertising are greater. The reader of the magazines and newspapers are a select class with great buying power, and although the circulations of these publications are small compared with similar publications in this country, the advertising rates per thousand of circulation are quite reasonable.

It is important to the future development and growth of our export trade, that we create a sentiment in this country favorable to the export business. The public should be made to realize and appreciate the importance of this business to the continued growth and prosperity of our county. Legislation, favorable to the maximum development of our overseas trade, should be encouraged, and existing laws which hamper the growth of our foreign business, should be repealed.

Safety Rules for Gas-Torch Workers

The following rules have been adopted by the Western Pennsylvania Division of the National Safety Council:

Equipment Rules

1. All pressure tanks should be fitted with safety relief devices, and tanks not so equipped should not be used.

2. The equipment should include a high-pressure gage to indicate the pressure on the tank, a reducing valve, and a low-pressure gage to indicate the pressure on the torch. These should be assembled as one unit and so arranged that they need not be separated when they are attached to, or detached from, the tank. The two gages should have different-sized openings; one should have a right-hand thread and the other a left-hand thread so that they cannot be interchanged. There should be one of these units for the oxygen tank and one for the acetylene tank.

3. All pressure regulators should be equipped with a safety relief valve which will relieve the pressure from the diaphragm and low-pressure gage in case the high-pressure valve should develop a leak.

4. Wire-wrapped hose should not be used.

5. The oxygen and acetylene hose should be of different

color or the couplings should be stamped for identification purposes, so as to avoid interchanging the hose.

6. The torches should be of a type which will not backfire.

Rules for Operation

1. Under no condition should acetylene be used where the pressure is greater than 15 lb. per square inch.

2. Special care should be given to the storage of oxygen and acetylene tanks. Acetylene is classed as an explosive, and only a limited number of containers should be stored in any one place. Oxygen tanks should be stored in a separate place from acetylene tanks.

3. Oxygen and acetylene tanks should not be allowed to remain near stoves, furnaces, steam heaters or other sources of heat, and should not be exposed unnecessarily to the direct rays of the sun, as an increase in the temperature of the gas will cause a corresponding increase in the pressure within the tank. Any excess of heat may also soften the fusible safety disk with which the tank is provided, causing it to blow out and permitting the gas to escape.

4. Oxygen tanks should never be handled on the same platform with oil or grease which might find their way into the valves on the tanks.

5. Oxygen and acetylene tanks should never be dropped nor handled roughly, and should never be stood on end unless fastened so as to prevent them from falling over.

6. Tanks should not be handled by crane, either magnetic or mechanical.

7. All empty tanks should be marked plainly with the word "empty" and returned promptly to the storeroom.

8. An open flame should never be used for the purpose of discovering leaks in acetylene tanks. Leaks can generally be detected by the odor of the acetylene gas, and their location can be determined by applying soapy water to the surface of the tank and watching for the soapy bubbles formed by the escaping gas.

9. No repairs to oxygen or acetylene tanks or equipment should be made or attempted. All defects should be reported promptly to the foreman, and by him to the manufacturer.

10. Leaking acetylene tanks should not be used, but should be placed in the open air and all open lights kept away from them. All leaking acetylene tanks should be reported promptly to the foreman and immediately returned to the manufacturer.

11. All open flames should be kept away from any place where there is any possibility of acetylene escaping.

12. Care should be taken to protect the discharge valves of tanks from being bumped, as a jar may damage the valve and cause it to leak.

13. Grease in contact with oxygen under pressure may cause spontaneous ignition. Great care should be taken not to handle threads or valves with oily hands or gloves, and gages should not be tested with oil or any other hazardous carbon. If a lubricant must be used, the purest glycerine is permissible.

14. Gages, apparatus and torches requiring repairs should be sent to the manufacturer, and local repairs should not be atempted. Valve seats should never be replaced except by the manufacturer.

15. The use and operation of the pressure regulator or reducing valve on oxygen or acetylene tanks should be as follows: (a) Open the discharge valve on the tank slightly for a moment and then close it. This is to blow out of the valve any dust or dirt that might otherwise enter the regulator. (b) By means of the stud or nut connection on the regulator, connect the regulator to the discharge opening of the tank. (c) Release the pressure-adjusting screw of the regulator to its limit. (d) Open the needle valve slightly if there is one. (e) Open the discharge valve on the tank gradually to its full width. (f) Open the needle valve to its maximum if there is one. (g) Adjust the pressure-regulating screw until the desired pressure is shown on the low-pressure gage.

16. The discharge valves on the tanks should be opened slowly, and care should be taken to avoid straining or damaging them by the use of a hammer or the wrong kind of wrench. A special wrench should be made for use in opening these valves in case they stick.

17. When the operation of the cutting or welding torch is stopped for a short time, the needle valve on the regulator should be closed, or the pressure-adjusting screw should be released to keep the pressure off the hose. The torches should be opened momentarily to let the pressure out of the hose lines.

18. All tanks should be inspected at the close of the day's work.

19. Proper precautions should be taken to protect the hose from flying sparks.

20. All hose should be examined periodically at least once every week. This should be done by cutting the hose off at the end of the connection and examining it. In addition, after a few months' use, the hose should be cut off about two inches back of the connection and examined for defects. A defective hose should never be used.

21. Special care should be taken to avoid the interchange of oxygen and acetylene hose or piping, as this might result in a mixture of these gases that would be highly explosive. The practice of using right- and left-hand threads is recommended.

22. White lead, grease, or other similar substances should never be used for making tight joints. All joints and leaks in equipment should be made tight by soldering or brazing.

23. The oxygen and acetylene valves at the base of the torch should be tested daily for leaks.

24. Where hydrogen or other gas is used instead of acetylene, the same precautions should be observed as for acetylene.

25. A fire extinguisher should be carried as regular equipment to be used in case of fire.

26. Men using welding apparatus should wear suitable welding goggles for eye protection, having frames that are nonconductors of heat (not celluloid), side shields to protect against hot particles of metal, and lenses of proper color.

27. Operators' clothing should be fireproof.

28. If valves become frozen, they should be thawed by hot water, not by flame or hot metal rod.

29. Home-made generators should never be used, as they are unsafe. Only generators permitted by the Board of Underwriters should be used.

30. Where acetylene is used from generators, or is piped through the plant, an approved water seal should be interposed between the generator and the piping system, and individual water seals should be placed at each blow-pipe. Water Seals should be inspected daily without fail.

31. Portable generators should not be used inside the building.

32. Safety devices on tanks, generators, or apparatus should not be removed or tampered with.

33. In welding brass or bronze, injurious fumes may be given off, making it desirable to wear a respirator.

34. Smoking while on duty should be prohibited.

35. Electric lights in a generator house should be enclosed in vapor-tight globes protected by the regular guards.

36. Snap switches should be placed outside of the generator house in a suitable place, provided the house is isolated.

37. Piping which is used to carry acetylene or hydrogen should be painted a distinctive color.

38. The manufacturers should provide couplings for the hose which cannot be mistaken and put on the wrong hose. If the couplings could be made only with the proper connections, it would be impossible to make a mistake.

39. In storage houses where hydrogen or acetylene tanks are stored, the wiring should conform to the same rules as for the generator house, so that an explosion could not be caused by defective wiring or a break in the bulb.

40. The valves on the piping should contain neither copper, brass, nor bronze.

41. In opening the outlet valve of a full tank, do not remove the regulator.

42. The operator should not stand in front of the gages when opening the discharge valves on the tank. If the pressure goes off suddenly, it may possibly destroy the gage and the glass, and parts will be blown out at the front.

43. A label should be placed on every tank of oxygen, stating that it should be kept away from grease.

Milling Teeth of End Mills

BY ADOLPH MOSES

In shops where the cutting of end-mill teeth has been done by the good old cut-and-try methods, the accompanying chart will save much valuable time of both man and machine. This saving will of course be most marked where the number of set-ups is large in proportion to the number of pieces milled.

Not only will the use of the chart save time, but what is more important, the most suitable tooth angle and number of teeth for the end mill may be easily estimated in advance by the tool designer. The angle

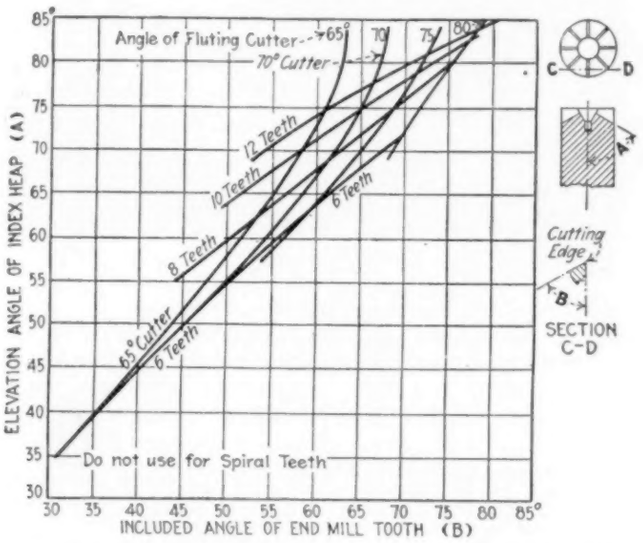


CHART FOR DETERMINING SHAPE AND NUMBER OF TEETH IN END MILLS

B gives us an indication of the tooth strength, while the angle *A* shows the depth of the cut which, together with the angle of the fluting cutter or the number of teeth, will enable the user to judge the proper amount of clearance space to be allowed for chips.

The following are a few examples to illustrate the use of the chart:

Example 1: Given the number of teeth as 10 and the fluting cutter angle as 65 deg., what will be the elevation angle and tooth angle?

On the chart we find where the 10-tooth line crosses the 65-deg. cutter line. On the left end of the horizontal line through this point read the elevation angle (70 deg.) and at the lower end of the vertical line through the same point read the tooth angle (57½ deg.).

Example 2: Given the number of teeth as eight and the approximate tooth angle as 60 deg., what fluting cutter and elevation angle should be used?

Find the intersection of the 60-deg. tooth angle line and the eight-tooth line and note which fluting cutter line crosses the latter nearest to this intersection. In this case it is the 70-deg. fluting cutter which will give a tooth angle of 61½ deg. and an elevation of 69 deg.

As it is the tooth shape and chip space that limit the work a cutter of a given diameter and material will do, it would be logical to start with the tooth angle and elevation angle desired and find the fluting cutter angle and number of teeth.

Example 3: Given the tooth angle ($B = 55$ deg.) and the elevation angle ($A = 65$ deg.) find the fluting cutter and number of teeth.

Find the intersection of the vertical line through 55 deg. on scale *B* with the horizontal line through 65 deg. on scale *A* and note the fluting cutter line and number of tooth line that intersect nearest to this point. The eight-tooth line and 65-deg. fluting cutter happen to be the values sought.

The designer could then specify the number of teeth, angle of fluting cutter, and elevation angle with the knowledge that he would get the kind of a cutter he wanted.

Another advantage of knowing the elevation angle in advance is that we can judge the required diameter and depth of the hole or center in the end by laying out the elevation angle, and in so doing be assured that the lines forming this angle will pass through the center of the end surface. That will be a close approximation, and would be correct if the width of land were 0.

After one has used the chart several times it will be found that but a few seconds are required to find the quantities wanted.

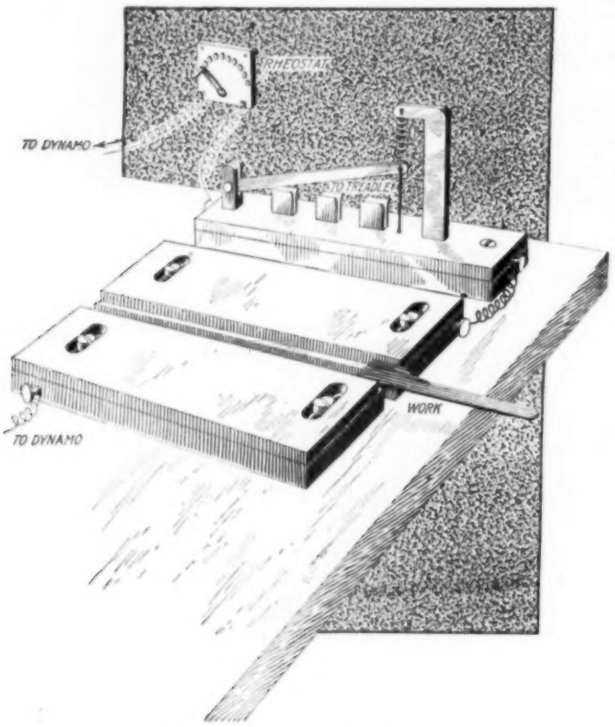
An Electric Annealing Device

BY S. E. CORY

A firm producing large quantities of small flat springs pressed from tempered stock, experienced difficulty in annealing the ends of these springs. Some forming operations had to be done upon the latter without drawing the temper of the spring so far as to render it useless.

After experimenting with gas and other means of heating, the following described device was installed which accomplished the desired effect perfectly, limiting the heated area to ¼ in. in length, if so desired, and enabling an operator to turn out the pieces at almost

press work speed. The device was made by fastening copper pieces upon a slate slab together with a single-pole knife switch arranged to be operated by a treadle. Slotted holes in the copper contact pieces permitted adjustment for different widths of spring and one of the



ANNEALING BY ELECTRICITY

contacts was made of two separate pieces so that it acted as a gage to assist in placing the work.

Current was supplied from a convenient plating dynamo of large capacity and a rheostat was placed in the circuit to control the current flow, so that the operator could not spoil a piece of work by leaving the current on too long.

Calculations for an Underslung Formed Cutter

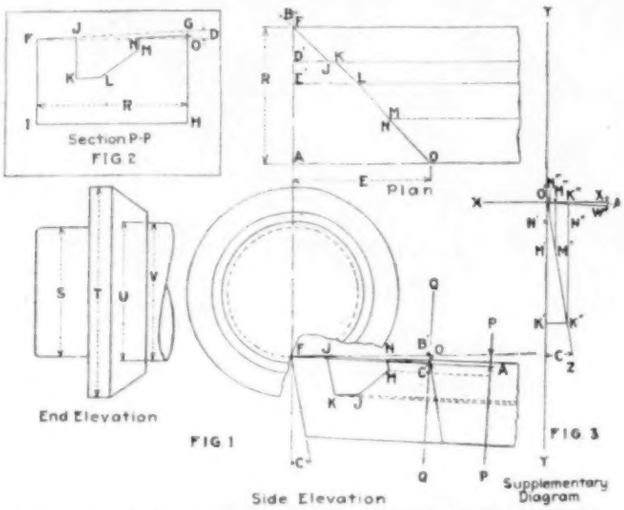
By Arthur R. Melloy

For work like the turning job illustrated, the underslung formed cutter may be used. There are several things to be taken into account in the making of such a cutter and the design is more or less complicated. Fig. 1 shows three views of the cutter in position to turn a band on a cylinder. In the side elevation, a line parallel to the horizontal center line is drawn tangent to the smallest circle which represents the rear of the cylinder. The cutter travels back and forth beneath the work parallel to this line. The top rake is obtained by inclining the cutter at an angle A, and a front rake is given at an angle C. To reduce the shearing edge in contact at any one time, the shearing angle B is laid out as shown in the plan.

The first thing to do in designing the cutter is to determine the shape of what is known as the master section, Fig. 2. This is a cross-section $FGHI$ perpendicular to the long axis of the tool and is of such a shape that it would produce a true cylinder if the tool is given the top rake as shown. It is not a cross-section of the tool itself, but is a reference section from which the tool would be cut and is dependent upon the angles A and B, Fig. 1.

If the tool were fed in without a top rake, the master section would be a rectangle as shown by the lower dotted line in Fig. 2, but the use of a rake and shear angle necessitate this raising of the upper right-hand corner to G and the coincident adjustment of the whole upper surface. To find the amount to raise this corner, we take the triangle AOF in the plan, Fig. 1, in which we know the values of the width R and the angle B. We can then calculate the value of E which is $R \tan B$. Lay off FB' in the side elevation equal to E, and draw a line QQ through B' perpendicular to the elements of the tool. $B'C'$ is the amount that the corner must be raised to enable the master section to cut a true cylinder, and may be found from the expression $B'C' = E \sin A$. Putting this value in section P-P and drawing FG gives us the master section and the angle of inclination D of its upper boundary. All parts of the cutting edge which cut cylindrical surfaces must be parallel to FG and the rest of the cutting edge must be located individually from it.

Having established the angle D, we proceed to locate the points J, K, L, M, N and O to get the actual cross-section of the tool. The point J lies on FG because FJ cuts a cylinder. K is located from J and not from the horizontal line. For this purpose we turn to the sup-



FIGS. 1 TO 3. DETAILS OF UNDERSLUNG CUTTER

Fig. 1—Cutter in position. Fig. 2—Master section and section of tool. Fig. 3—Supplementary diagram

plementary diagram Fig. 3 which has the rectangular coördinates XX and YY passing through the origin O', and lines $O'W$ and $O'Z$ forming the angles A and C corresponding to the similarly designated angles in the side elevation. We then lay off on YY to an enlarged scale, $O'K'$ equal to half the difference between the diameters T and S in the end elevation or, in other words, equal to the depth of the groove in the tool if it had been fed in without the top rake. Draw $K'K''$ perpendicular to YY, and $K''K'''$ perpendicular to $O'W$. This will give the vertical distance between J and K in section P-P by graphical methods. Greater accuracy can be obtained if the scale of the supplementary diagram is enlarged. If desired, the actual length of the line can be calculated by simple trigonometry as follows:

$$O'K' = \frac{T - S}{2}, \quad O'K'' = O'K' \div \cos C$$

$$K''K''' = O'K'' \sin [90° - (A + C)]$$

Similar constructions or calculations will give $M''M'''$ and $N''N'''$, so that we can locate M and N in Section P-P, L will be located by drawing KL parallel to FG, until it crosses a perpendicular whose distance from K is equal to $D'E'$ in the plan. Then we can connect L with M, and draw NO parallel to FG, completing the outline of the cutting edge. The locations can be checked by trigonometry as described for J and K if desired. The problem is simply that of projecting the lower contour of the projectile in the end elevation upon the plane indicated by P-P in the side elevation.

Shaft-Aligning Elbows

By Phil D. Carr

An awkward problem in aligning brackets for shafts which are set at right angles and connected by bevel gears has been solved by the Cincinnati Planer Co., Cincinnati, Ohio, by the method shown in the illustrations. Machine-steel elbows are used similar to the one at *A*, Fig. 1. These are first ground on the top face, and from this location the two shaft bearings are bored accurately in the same plane and 90 deg. apart. They are made in various sizes to handle the different bevel-gear connected shafts on boring mills.

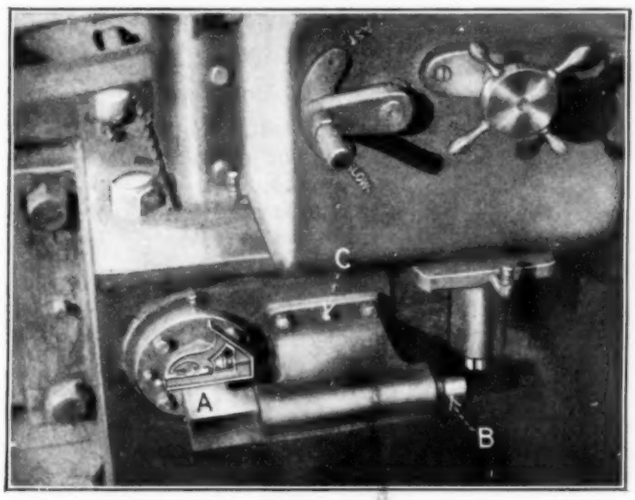


FIG. 1. ALIGNING A LOWER FEED-SHAFT BRACKET

In Fig. 1, a fixture *A* of this type is being used to align the feed-shaft bevel-gear bearing by placing it alternately on the ends of the two shafts. The short shaft *B* is then leveled and the dowel-pin holes *C* drilled to insure its correct position.

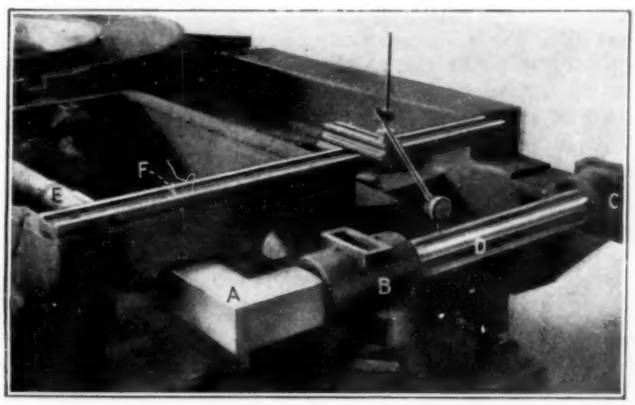


FIG. 2. ALIGNING BRACKETS FOR A BACK-DRIVE SHAFT

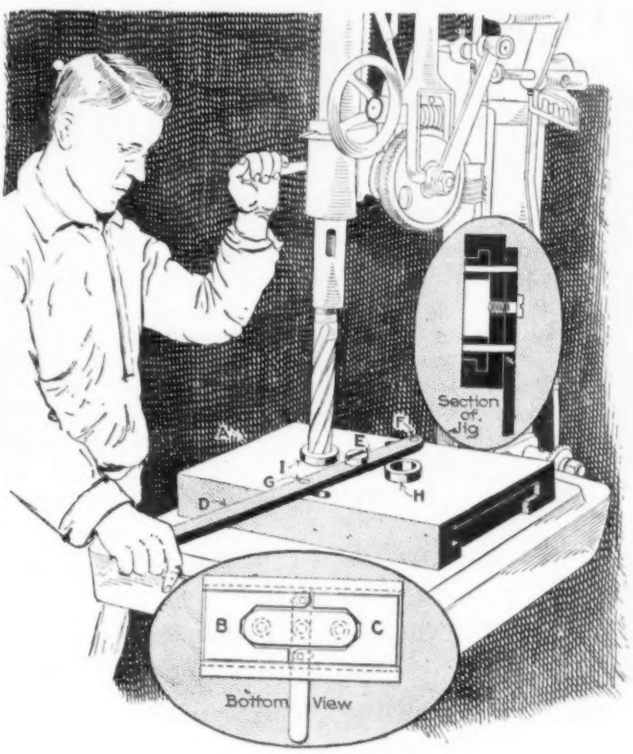
Another application of the fixture *A*, Fig. 2, is to align the brackets *B* and *C* holding the back-drive shaft *D* in correct position relative to the shaft *E*. To level this shaft accurately, a straight-edge *F* is laid across the planed surface of the bed and a surface gage with micrometer indicator is used to level up the shaft while wedging the brackets in position before drilling their dowel-pin holes. This method insures the perfect meshing of and prevents binding of the shafts.

A Compensating Jig for Drilling Links

By M. Jacker

A compensating jig to drill small link castings that vary slightly in both length and width, and at the same time maintain the drilled hole at an equal distance from either end, is shown in the sketch.

A is the body of the jig slotted its whole length to receive the two movable jaws *B* and *C*. The latter are operated by the lever *D* pivoted to the body of the jig at *E* and engaging the jaws by means of the pins *F* and *G*. Two hardened drill bushings *H* and *I* guide the drill. A link is shown in position ready to be drilled.



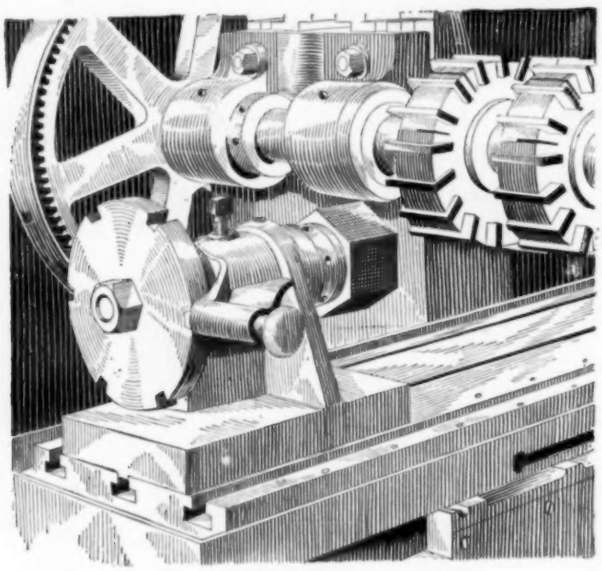
A COMPENSATING JIG

A Special Indexing Fixture for Milling Large Nuts

By W. C. Loring

The special indexing fixture shown in the accompanying picture was designed by the A. F. Way Co., Hartford, Conn., to be used on a Lincoln milling machine for milling the sides of gun-mount nuts of 1 in. and 2½ in. internal diameter. The inspection requirements on these parts were quite rigid, and it was necessary to hold the radial distance from each face to the center of the nut to very close limits.

The spindle of the indexing head is hollow and is made to fit the shank of a plug gage by means of which the cutters are set up. After setting, the plug is removed and a threaded plug is substituted upon which the nut is screwed, the thrust of the nut being taken by a compensating washer. A washer and left-hand screw



SPECIAL INDEXING FIXTURE

in the end of the plug prevented the nut from working loose under the cut. As the nut blanks were rough-forged to a hexagon shape, it is necessary to provide means of turning them approximately in line with the cutters. This was done by loosening the nut on the drawrod at the end of the machine. The setscrew at the top of the device served as additional security to hold the work rigidly in position after the latch was in place in one of the notches. The fixture has given very satisfactory service.

Cutting Threads of Unusual Pitch

BY J. DAVIES

On page 451, Vol. 50, of *American Machinist* is an article by Miles C. Smith on cutting threads of unusual pitch, in which he endeavors to show that 19 threads per inch can be cut with the lathe set up for 20 threads,

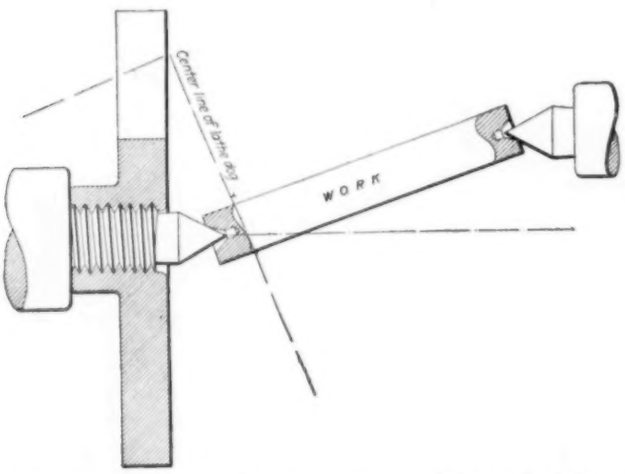


DIAGRAM SHOWING RELATIVE POSITION OF WORK

by settling over the tailstock in conjunction with the taper attachment and that it will be absolutely accurate. I beg to differ with Mr. Smith as far as the "absolute accuracy" of the thread is concerned.

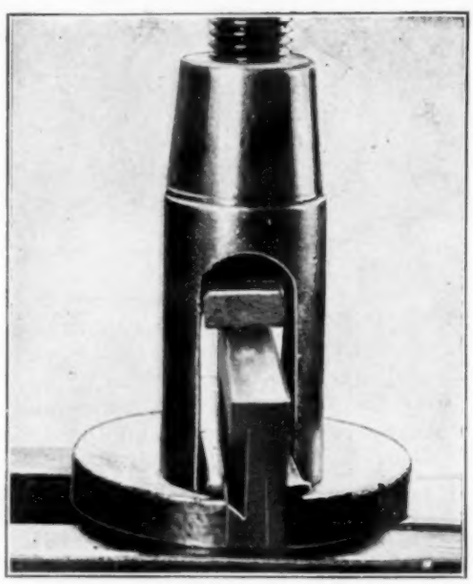
Let us take the example given, that of a piece of work 6½ in. long, threads required 19 per inch with the lathe geared up for 20 threads; according to formula given, the taper attachment should be set to 18 deg. 10 min. and the tailstock offset 2.026 in. which would give a result as shown in the sketch. Apart from the very unsatisfactory fit of the centers, work driven by a dog in such a manner would not give an accurate thread because, while the lathe spindle would have a uniform motion and keep a constant ratio with the lead screw, the work between the centers would not. The tail of the dog would slide in and out and up and down the slot in the faceplate, thus accelerating and retarding the speed of the work between the centers, and instead of having perfect threads you would have irregular threads caused by the cam-like action.

A Shoe for a Toolpost Screw

BY FRED D. HOOD

The cut shows a device applied to the lower end of a toolpost screw to avoid crushing down the upper edge of toolholder shanks after repeated use.

The end of the screw is formed into a ball and hardened. The shoe is made to approximately the width



SHOE FOR TOOLPOST SCREW

and length of the slot in the post, the upper side being cupped out to fit the ball while hacksaw cuts are run down at right angles to each other, about ¼ in. deep, to leave four prongs to be hammered around the ball to prevent the shoe falling off. The latter may be case-hardened before being closed on the setscrew.

Where tools are changed very frequently, case-hardened toolholder shanks soon crush down under the screw. The device protects the screw from crushing as well as the tool.

The writer has applied this to 18 lathes of different makes in this shop with good results. In some cases new toolposts had to be made to give room enough for the shoe.

Business Training Recommended for Engineers

At the call of the Commissioner of Education, a two-day conference was held in Washington, June 23-24, and was attended by over 150 educators, representatives of engineering firms and prominent engineers. The concensus of opinion was expressed in resolutions passed at the final session favoring the addition to engineering curricula of courses in general economics, cost accounting and business law and urging that the economic phases of engineering subjects be emphasized in commercial instruction, and that the institutions that have departments of engineering and economics or commerce be urged to consider some plan of coördination to develop a course to prepare candidates to meet the demand for large numbers of technically trained men for both foreign and domestic commerce.

At the first session, Dean Anson Marston, of Iowa State College, led the discussion on business training for the engineer. Spencer Miller, vice president of the American Society of Mechanical Engineers and of the Lidgerwood Manufacturing Co., New York, placed first the need for developing character and outlined the qualities needed in engineering salesmen and the golden opportunities awaiting them. In the discussion was pointed out the danger of attracting too many men from the fields of design and research work, and the fact that it would be a mistake for all colleges to begin to train business engineers. Prof. G. H. Follows, of the department of commercial engineering at Carnegie Institute of Technology, Pittsburgh, outlined the course by chart and declared that a complete commercial training filled a four-year course, it being almost impossible for men who had taken ordinary engineering courses to become managers of men. It was stated that the reorganization plans at Harvard and Yale universities contemplate such specialization in the fifth year as graduate work.

Prof. Walter Rautenstrauch, of Columbia University, in discussing engineering training for commercial enterprises, insisted that no worthwhile instruction could be given without highly paid teachers. A department of manufacturing is contemplated at Columbia as a six-year course. E. F. Dubrul, president of the Pyro Clay Products Co., Cincinnati, claimed that the science of business was as broad and its ethics as high as any profession, and that executives are highly paid because they control both the engineering production and the commercial or distribution phases of industry. Money will be provided by business men if the educator will show willingness to adopt new methods for supplying the kind of graduate they need—the course to be devised in conference. He called attention to the new college of engineering and commerce at the University of Cincinnati as offering a coöperative course of large promise. In the discussion a Colorado executive was cited as authority for warning against too many business engineers, claiming fifty technical men were needed to one executive.

War Experience and Education

The third session was devoted to the significance of the war experience for engineering education, a paper by Maj. Gen. John F. O'Ryan, of New York, being read by Mr. Swiggett. He pointed out the shortcomings of the present educational system in character training and suggested as a remedy the inclusion of nonsectarian moral law developed and applied by courses of psychology, leadership, responsibility and physical training. He urged a scientific program for developing professional character.

Dr. Charles R. Mann, chairman of the Advisory Board, Committee on Education and Special Training of the War Department, pointed out that both army men and practicing engineers place character first. He raised the question as to just what is meant by the "fundamentals" which so many advocate, and claimed that these fundamentals are at once apparent if the army method of beginning with a definite job asking what the engineer has to do, is followed. Thus the motive is developed, and results follow because the student is doing something definite and learns to think on the job. Morale is a dominant factor, better than character as a test, and he would judge classwork by group morale. The teacher should be a friendly investigator trying to lead the student to his best attainments rather than one who merely tries to meet certain set standards—and generally failing in a large proportion. The classification and rating system of the army should be applied—helping to measure accomplishments. The chairman, Maj. Gen. W. M. Black, Chief of Engineers, U. S. Army, advocated less individualism and the development of more coördination; also training for self-mastering through the subordination of passion to duty. He deplored over-specialization and suggested that engineering degress should be withheld until after practice in actual engineering work had really qualified the graduate as an engineer.

At the last session, on Training for Overseas Engineering Projects, A. W. McLean, director of the War Finance Corporation, Washington, as chairman, emphasized the need for financing foreign investments, and for this country to assume to lead in foreign fields, claiming that engineers and business men can take the position of leadership if they have the courage and enterprise. C. H. Gardner, of the American International Corporation, New York, advocated more training in vision to see opportunities, especially in transportation, saying that the engineer should be the pioneer. He would have French and Latin required for college entrance. W. W. Nichols, chairman of the American Manufacturers' Export Association's Committee on Education, pointed out that industry and engineering are mutually dependent, that pure engineering belongs only to rare genius, and that the rank and file of engineers need a practical training. Foreign languages should be taught to develop knowledge of customs and mental attitude of the foreign peoples.

Dr. Jeremiah W. Jenks, research professor, government and public administration, New York University, in an illuminating address, showed two kinds of problems—to get trained men at once for overseas service and to develop such men for holding future supremacy in foreign trade. He classed commerce as one of the humanities, on a par with history and economics. Credit should be furnished in foreign fields, but only by controlling stock interests in order to insure wise and successful management. The discussion by men in industrial concerns interested in foreign fields, developed the necessity for long-time credits and for using ingenuity to find men with language qualifications and also sufficient technical knowledge to represent them abroad.

The Destruction of Belgian Industrial Establishments by the Germans

In compliance with an order dated Mar. 23, 1919, Capt. M. B. Chapman of the Marine Corps, accompanied by representatives from Luxembourg and Belgium, visited a number of plants that were located in the area occupied by the Germans and formerly engaged in the manufacture of iron, steel, metal and other products of all kinds, such as rails, beams, channels, angle bars, joints, plates, tie plates, forgings, castings, blooms, tools, machines, engines, electric motors, locomotives, turbines, cranes, artillery, rolling mills, paper-making machinery, steel rope, railway and street cars, coke, cloth, yarns, artificial silk and printing. The plants visited were located around Liege, Ghent, Brussels, Nivelles, Charleroi, Namur and Mons.

The report of Captain Chapman seems to indicate that there was a very general destruction of Belgian industrial establishments, and the following extracts from his report give some ideas as to work that was done along these lines:

The Germans commenced dismantling and destroying industrial installations on a large scale as early as March, 1915, and were still engaged in this work the morning of

the armistice. In many instances brick and masonry walls of very large structures were entirely demolished, steel-framed roofs broken up or taken away entirely, foundations of rolling mills and immense pieces of machinery were dynamited, the bolts holding them cut, thus making it impossible to relocate machines and mills again on the same foundations without tearing up the debris of the old and building entirely new ones. In many places large iron and steel columns supporting steel frames covering the floor space of huge buildings were cut near their bases by acid, liquid air, hydrogen-oxygen gas, or other means. One end of a large steel rope would be attached to the column or frame and the other to a locomotive which would then proceed to pull the entire structure over in a mass. The Germans had alleged the need of scrap for this wholesale wrecking, but immense steel-frame buildings were left in this state without the removal of any of the material ostensibly sought. Electric traveling cranes were used to elevate and lower large steel hammers, whose blows smashed up machinery or material as rapidly as it could be placed within range. I was told that the Germans carried on their destruction and dismantling in a systematic manner, and for this purpose operated several departments under the immediate control and direction of civilians.

I am uncertain whether this devastation was simply wanton destruction or carried on for the purpose of putting the iron and steel industry out of business as a competitive factor. The Germans expended their greatest destructive efforts in the direction of the iron and steel machinery, metal and related industries, and in this they have succeeded to a very large measure. Blast furnaces were torn down on the pretext of obtaining a few thousand firebrick linings, but these to a very large extent were not carried away. They removed to Germany many thousands of fine machines for operation and in other cases scrapped very valuable machines for the purpose of recovering small quantities of copper and other metals.

The destruction may have been wanton, or perpetrated to destroy a competitive industry; it may have been carried out as a military measure in case of the eventual retirement of the German army in order to prevent their enemies from using the potential iron and steel resources of Belgium. Reconstruction naturally involves many factors.

The coal industry (production, 1913, 23,000,000 tons), the most important in Belgium, suffered very little injury to its industrial equipment and mines. At present Belgium seems to have, as far as I can ascertain, no definite policy in respect to the reëstablishment of its economic life. Practically every big business concern which has been disorganized or destroyed by reason of the war is waiting for the large indemnity, the furnishing of raw and finished materials, and the return of tools and machinery taken away. These they expect to secure from the German government. After this happens they will commence the reconstruction. The financial, commercial, social and economic conditions in Belgium at the present time are unquestionably serious. The important business men seem to lack nerve and morale and have no confidence in the future. The government is paying thirty million francs per month to the unemployed; men are standing around the streets doing nothing, and business seems to be drifting.

Correction

On page 1043, Vol. 50, in the last paragraph of the article on "The Manufacture of Semi-Steel Shells," it is stated: "The government specifies the mixture that shall be used and also the depth of metal that shall be cast above the top of the core."

Maj. F. F. McIntosh, head of the Metallurgical Branch of the Ordnance Department, informs us that this statement is incorrect, as Government specification number EA 182-2, which is the latest specification for casting and machining semi-steel projectiles, makes no attempt to govern the mixture used or the depth of metal to be cast above the top of the core.

Burnishing Tool for Ball Races

By Oliver F. Warhus

The illustration of some ball races, Fig. 1, which were finished by a special tool of the writer's design, shows the high degree of burnishing which can be applied to their surfaces. These were finished from bar stock in a Cleveland automatic screw machine and, for the

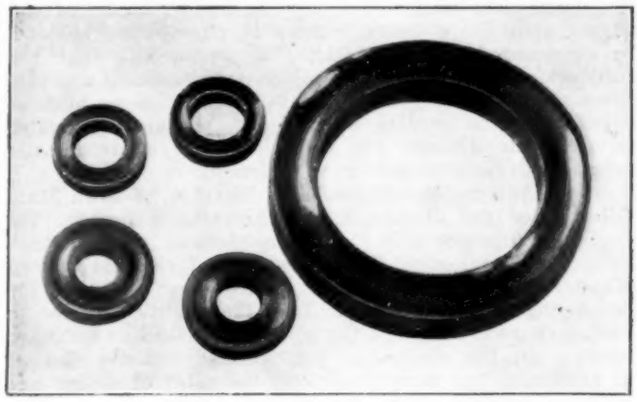


FIG. 1. BALL RACES BURNISHED BY SPECIAL TOOL

final finishing operation, the burnishing tool, shown in section, Fig. 2, is pressed against the surface of the race. The hardened-steel balls *A* on the face of the tool are run in the grooves of the race until a few revolutions have completely burnished the surface.

The balls are of exactly the same diameter as the race and are held accurately centered in position by the cap *B*, and thrust against the hardened-steel bearing *C*, upon which experience has shown they exert no appreciable amount of wear.

The bearing sleeve *D*, which supports the burnishing balls and thrust bearings, slides on the stud *E* and is

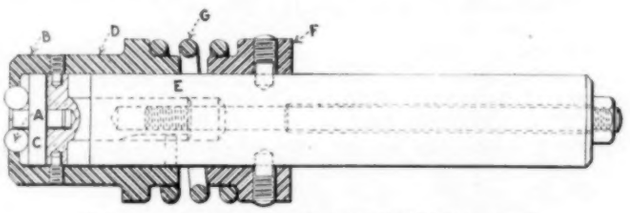
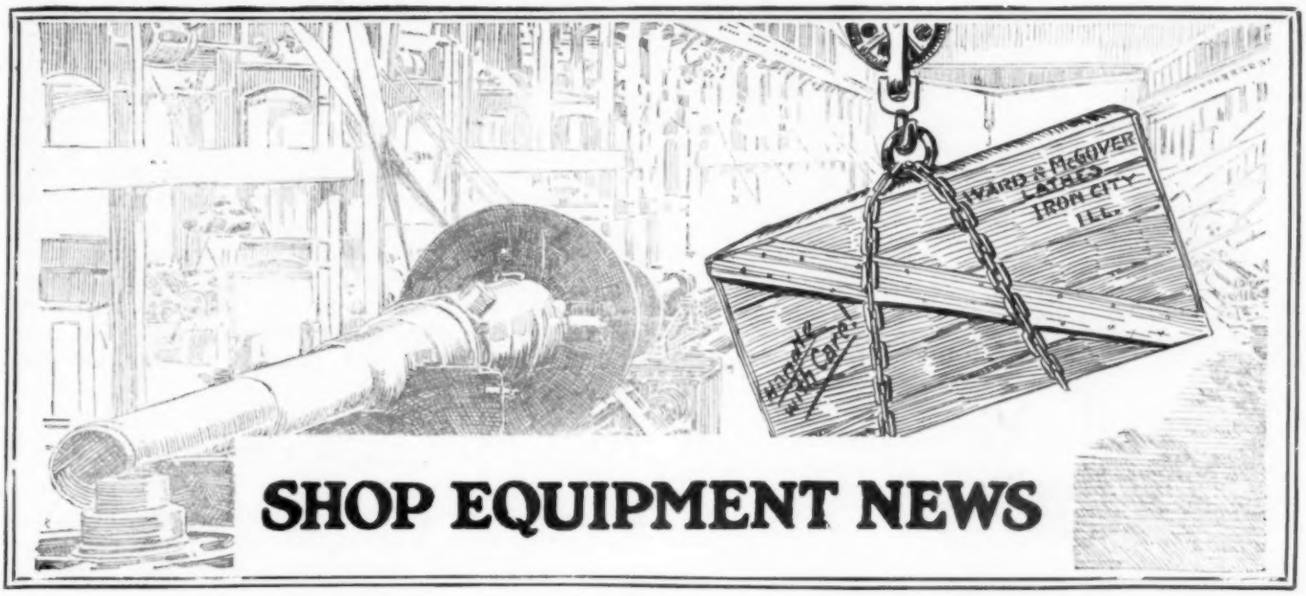


FIG. 2. SECTION OF BURNISHING TOOL

held forward away from the fixed sleeve *F* by means of the coil spring *G* which permits the tool to be advanced so that a certain amount of pressure will be maintained on the balls throughout the burnishing operation. The first spring which was made for this purpose did not seem stiff enough and was later replaced with a coil spring made from square spring wire instead of round, and the additional amount of stiffness furnished by this wire of larger section was sufficient to exert the required pressure for burnishing. The shank of the tool was designed to fit in the turret of the automatic screw machine and performed its function without further attention from the operator.

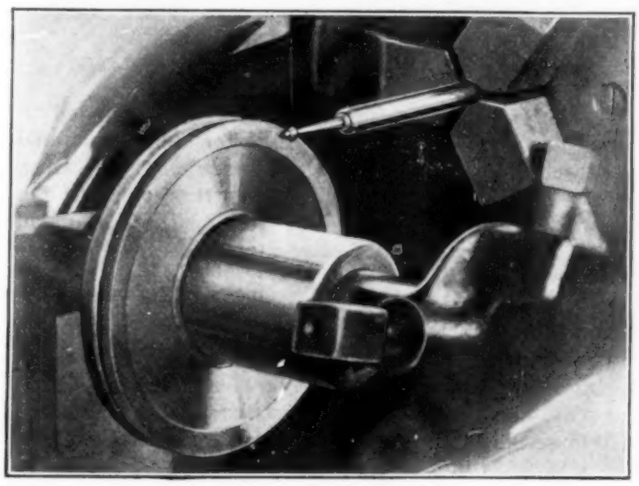
The finish on the ball races was very satisfactory, and by exercising due care in pack-hardening them to prevent oxidation and the formation of scale, the finished surfaces were not materially spotted. After the hardening operation the surfaces were given further polish by mounting the races in a high-speed chuck and polishing them for a moment with a hard-wood stick.



SHOP EQUIPMENT NEWS

Boston Wiggler

The illustration shows a wiggler for use on milling- and drilling-machine work that has recently been placed on the market by the Boston Tool and Manufacturing Co., Inc., 262-280 Dover St., Boston, Mass. The device consists of a cylindrical body, carrying in one end the

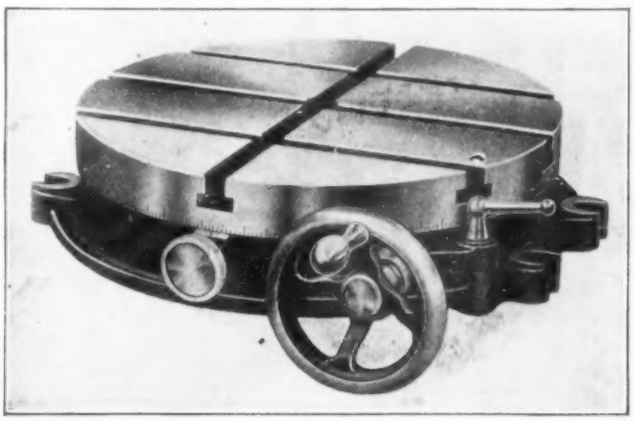


BOSTON WIGGLER

movable pointer, and is shown in the illustration in use on a milling machine. The device will give the true center of the spindle quickly, enabling the rapid laying out of positions for holes on surfaces, etc.

Knight No. 2 Circular Milling Attachment

The No. 2 circular milling attachment shown in the illustration has recently been placed on the market by the W. B. Knight Machinery Co., St. Louis, Mo., to be used as an attachment for the company's milling and drilling machines. This device consists of a base upon which is mounted a table of 15 in. in diameter, provided with four T-slots for bolting work. The circumference of the table is graduated in degrees, and may be clamped in any position by the knurled-head



NO. 2 CIRCULAR ATTACHMENT FOR KNIGHT MILLING AND DRILLING MACHINES

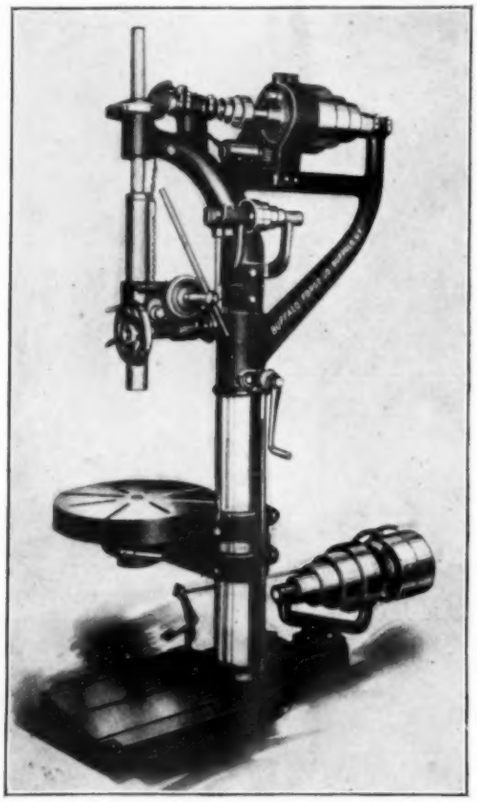
Diameter of table, 15 in.; T-slots, 4 in number, ⅝ in. wide; worm drive-shaft collar graduated to seconds; total height, 4 in.; net weight, 150 lb.

screw. The feed of the table is by a handwheel, but the worm of this drive may be easily thrown out of mesh and the table then turned by hand. The worm drive shaft is provided with a graduated set collar, which is graduated in seconds to provide for very accurate work. The base of the attachment has a rim which will collect the cutting oil and return it to the table of the milling machine.

Buffalo 25-Inch, Back-Geared Drilling Machine

The Buffalo Forge Co., Buffalo, N. Y., has recently placed on the market the 25-in., back-geared, upright, power drilling machine shown in the illustration. This machine is provided with eight speeds through a stepped-cone pulley and back gears, and four power feeds, as well as hand and lever feeds. The machine can be instantly changed from plain to back geared without using a wrench, by disengaging a knurled knob in the top gear and throwing in the back gears with a hand lever, a locking screw being provided to hold this in place. An adjustable automatic trip is provided that throws out the power feed when the work has been

drilled to any required depth. All split bearings are adjustable for wear, while ball thrust bearings are used to take up the thrust. The spindle is ground and the sleeve is graduated. The lever handle for the feed is adjustable from 6 to 18 in. in length and is held in place by a tension spring. The worm feed wheel runs in oil and is latch-hinged to take up wear. The large



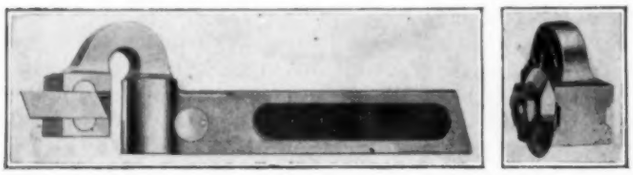
BUFFALO 25-INCH, BACK-GEARED DRILLING MACHINE

Height, 85 in.; capacity, up to 1¼ in., to the center of 25 in.; maximum distance between base and spindle, 44½ in.; maximum distance from table to spindle, 31 in.; travel of spindle, 14¼ in.; diameter of table, 21 in.; size of tight and loose pulleys, 10 x 3¼ in.; speed of drive pulleys, 300 r.p.m.; diameter of cone pulleys, 4 to 10 in.; feeds, four, 0.005, 0.007, 0.009 and 0.016 in. per spindle revolution; taper in spindle, Morse No. 3 or 4; weight with wheel and automatic feed and stop, 1550 lb.

crown gear runs in a heavy bronze bushing. The table is elevated or lowered by means of a screw operated by a crank mechanism and provided with ball thrust bearings. The table can be swung out of the way in case it is desired to place work on the base, which is T-slotted and planed to a surface.

Universal Adjustable Spring-Head Toolholder

The spring-head toolholder illustrated is a recent product of the Universal Tool Holder Co., 1565 East 17th St., Cleveland, Ohio. The device is intended for light production and tool work, and is adjustable to

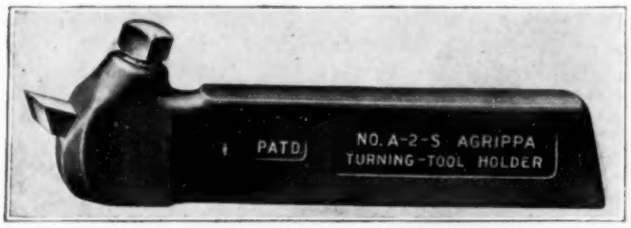


UNIVERSAL ADJUSTABLE SPRING-HEAD TOOL-HOLDER

any angle up to 90 deg. right or left, the spring giving a smooth cut and decreasing the possibility of chatter. The shank and spring clamp are forged of nickel steel, tempered and polished, and the method of securing tool bits is such that they can be used down to ½ in. in length. Thin parting tools made from old saw blades can also be held. The illustration also shows the method in which circular threading or forming tools may be held. The single clamp holds $\frac{5}{16}$-in. round, $\frac{5}{16}$-in. square and $\frac{3}{32}$ x $\frac{7}{16}$-in. flat bits, as well as circular threading or forming tools on either side. The spring clamp is in one piece, to prevent loss, and insure it being in proper alignment with the spring. The tool is made with a ½ x $1\frac{1}{16}$-in. shank, 6 in. long, and the shipping weight is 2¼ lb.

"Agrippa" Toolholder

J. H. Williams & Co., Brooklyn, N. Y., has just added a new line of setscrew pattern toolholders to the line of "Agrippa" toolholders already being manufactured. These new holders are made with a straight shank or with either right- or left-hand offset. They

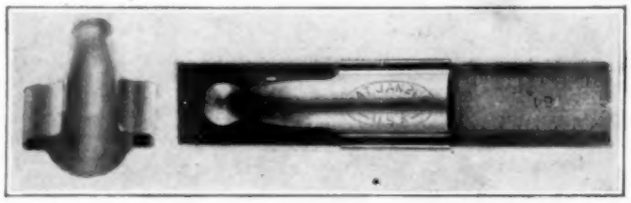


WILLIAMS "AGRIPPA" SETSCREW TOOLHOLDER

are made from drop-forgings, and are heat-treated to insure maximum strength. The cutter-holding channel is broached to size. The screws are of alloy steel, heat-treated and hardened. The cutters or tool bits are made from high-speed bar steel with a diamond point. A complete line of sizes is made.

W. J. B. Scale Clip

The W. J. B. Slide Ruler Clip Co., 43 Centre St., Springfield, Mass., has recently placed on the market the scale clip shown in the illustration. This is made in two sizes, as shown—No. 1 for flexible scales from $\frac{13}{32}$ to $\frac{17}{32}$ in. wide, and No. 12 for scales $\frac{1}{16}$ in. thick,

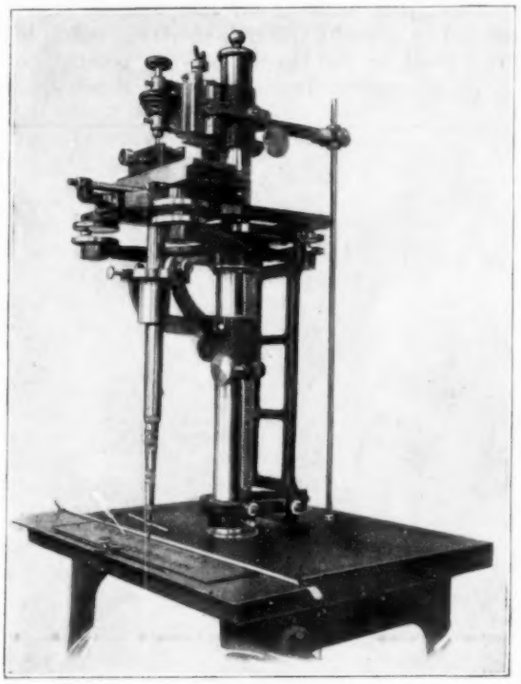


W. J. B. SCALE CLIP

and from $\frac{5}{8}$ to $\frac{11}{16}$ in. wide. Each clip is made of a single piece of spring steel, and can be easily adjusted for scales of different sizes by applying a slight pressure on the sides to close the clip or by applying the pressure on top to open the clip and make it wider. The clips not only serve to prevent the loss of the scale while it is being carried in the pocket, but can be conveniently used as a depth gage. The clip is manufactured in nickel finish.

Engraving Machine

The engraving machine shown in the illustration is of the routing type, having a rapidly revolving cutter driven by an electric motor, the machine being designed for the purpose of engraving in steel or other metals, or in ivory, celluloid, etc. It is the product of the Engravers and Printers Machinery Co., Sag Harbor, N. Y., and is known as the company's Model D. The machine is said to be of simple construction and very strongly and rigidly built, the operator standing directly in front where both the work and the master type

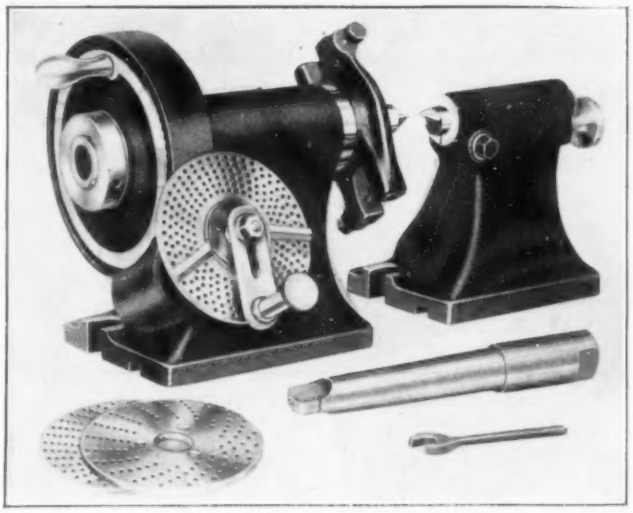


ENGRAVING MACHINE

or models are placed. The construction is such that the operator can use both hands in operating the stylus or tracer point, a feature that makes for more accurate work, as the danger of slipping from the guiding lines is lessened. The revolving cutter is brought into contact with the work by a foot-operated pedal, and the depth of cut can be regulated to the thousandth part of an inch. It is stated that this method of control gives additional speed in operating and an increased output. The unique feature of this machine lies in the facility with which a letter may be engraved in normal proportion, or extended or condensed from the same model or master type. The machine will handle work of varying thickness, and is said to be very good on production work.

Knight No. 2 Index Centers

For use on its No. 2 and No. 3 milling and drilling machines, the W. B. Knight Machinery Co., St. Louis, Mo., has developed a new set of index centers known as the company's No. 2. These are also adaptable for use on other milling machines. These centers have a swing of 13¼ in. The front end of the spindle, $1\frac{5}{16}$ in. in diameter, is threaded, and has a No. 10 B. & S. taper hole. The wormwheel is 6½ in. in diameter, and requires 40 revolutions of the index crank for one revolution



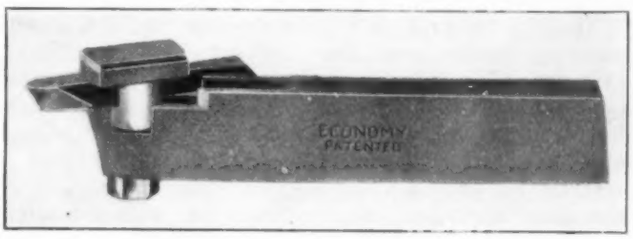
THE NO. 2 KNIGHT INDEX CENTERS AND EQUIPMENT

Swing, 13¼ in.; B. & S. taper hole in spindle, No. 10; total length of bases when head and tailstocks are placed center to center, 17 in.; diameter of wormwheel, 6½ in.; index crank makes 40 revolutions per revolution of spindle; total weight, 75 lb.

of the spindle. The worm screw may be readily thrown out of gear when it is desired to rotate the center rapidly to see if the work is running true. The equipment furnished with each set of centers consists of one No. 10 B. & S. taper cutter arbor, one index chart, three index plates, wrench and set of bolts for ⅝-in. slots.

Economy Toolholders

A new line of toolholders has recently been placed on the market by the Economy Tool Holder Co., 103 Park Ave., New York City. The toolholder is made in three parts, the holder itself, the vise and the nut, and may be arranged either straight or with right- or left-hand

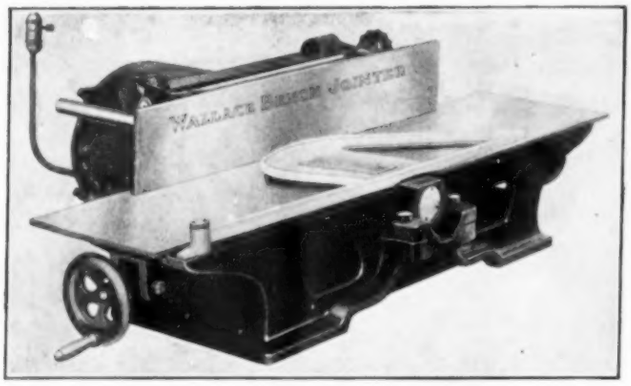


ECONOMY TOOLHOLDER

offset. Another advantage is that short toolbits can be used by placing another small piece of steel of the same size under the rear end of the vise. In using toolbits of ordinary lengths the whole length of the vise bears on the bit and is said to prevent breakage. Another feature claimed for the tool is that by reversing the bit the holder serves as a very convenient means for holding the tool while grinding. The holders are made in six sizes.

Wallace Bench Jointer

J. D. Wallace & Co., 1401-1405 West Jackson Blvd., Chicago, Ill., has recently placed on the market the new bench jointer shown in the illustration. This is a 6-in. machine and has many of the features incorporated in the 4-in. machine previously manufactured by this company. The machine is motor driven and is said to be



WALLACE BENCH JOINTER

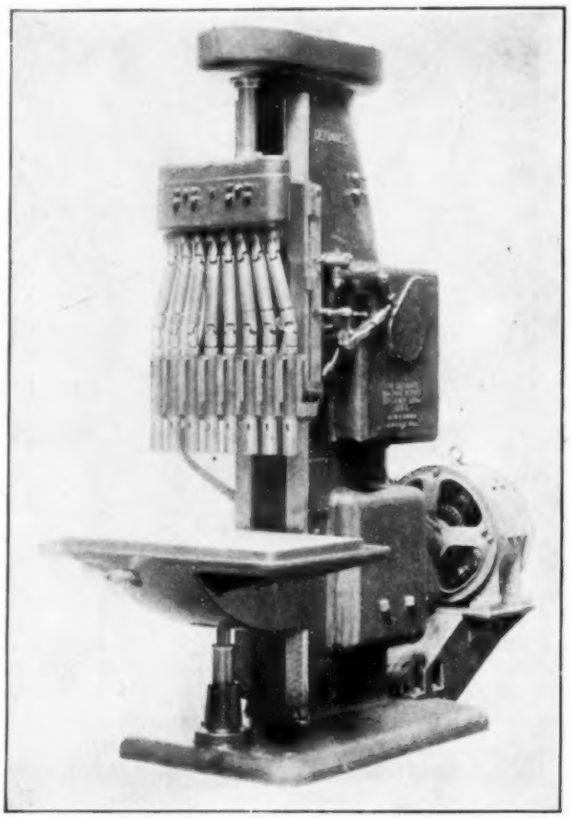
exceptionally powerful, despite the fact that it can be easily picked up and carried wherever the work is to be done, by one man, the operating current being obtained from any regular lamp socket. An interesting feature is the fence used in connection with the machine. This is mounted on the motor, and slides backward or forward on rods, a feature that is said to render adjustment accurate and rapid. The bench is also so designed that only a fraction of an inch is lost on the table when the fence in set for beveling. The motor is applied to the machine in such a manner that the cutter head can easily be taken out and changed in a few seconds. The table is arranged to slide backward to permit the use of special heads, or forward so as to work with the narrowest possible throat opening. Ball bearings are used on the motor and the cutter head. The flap and shutter guard are arranged for mounting the shutter guard on the cutter-head bearings rather than in grooves.

Defiance No. 10 Multiple-Spindle Drilling Machine

The No. 10 multiple-spindle drilling machine shown, a recent product of the Defiance Machine Works, Defiance, Ohio, can be equipped with a maximum of eight spindles with fixed centers, arranged in a straight line or cluster; or with a group of universally adjustable spindles arranged either in a straight line, a rectangular or a circular cluster. The machine is of the all-inclosed, unit-construction type; with a positive self-contained oiling system; automatic advance, feed and return of the spindles and is intended for production work.

The speed mechanism is located in the column near the base, and power is transmitted to a vertical drive shaft through gears. A friction clutch is used to engage the power and to select the proper back gear. The vertical drive shaft is fitted with a sleeve gear through which the spindles are driven, and this gear slides on the drive shaft with the spindle head as it is fed either up or down, this construction providing a drive closely coupled to the spindle head at any position on the column. Back gears are not furnished when the machine is arranged for a direct-connected, variable-speed motor.

The feed mechanism is housed in the column above the speed mechanism and consists of two friction clutches and a jaw clutch. The friction clutches are immersed in a bath of oil, and end thrusts are carried on SKF ball bearings. By engaging one of the friction clutches, the spindles are rapidly advanced until the drills come in contact with the work, at which point the jaw clutch is automatically engaged to feed the drills through the cut. When through the cut, the other friction clutch is automatically engaged, to effect a quick return of the spindles to the starting point. The levers operating these clutches are interlocking, preventing the possibility of more than one clutch being engaged at the same time. Feed changes are accomplished by removing the gear-case cover and changing two gears. The feed screw is operated from the feed mechanism through a vertical drive shaft and a train of spur gears. A bronze nut is used, and this is immersed in a bath of oil and located low in the spindle head to prevent the threads from being exposed when the head is fed to its lowest position on the column. The screw is located directly above the work,



DEFIANCE NO. 10. MULTIPLE-SPINDLE DRILLING MACHINE

Capacity, eight holes up to ¾ in. diameter; minimum distance from center to center of spindles, 2 in.; maximum distance from center to center of spindles, 22 in.; vertical adjustment of collet in spindle, ¾ in.; diameter of spindle nose, 1¼ in.; Morse taper in spindle, No. 3; diameter of joints, 1⅞ in.; maximum distance from nose of spindle to base, 44 in.; minimum distance from nose of spindle to base, 30 in.; maximum distance from nose of spindle to table, 32 in.; vertical travel of spindle head, 14 in.; distance from center of spindle to column, 9.970 in.; vertical adjustment of table, 12 in.; working surface of table, 20 x 36 in.; back gear ratio, 1 to 2; spindle speeds, six, 110 to 344 r.p.m.; horsepower recommended to drive, 7½; floor space of belt-driven machine, 42 x 84 in.; weight of belt-driven machine, 5300 lb.; floor space of motor-driven machine, 42 x 96 in.; weight of motor-driven machine, 5700 lb.

causing the vertical feed thrust to be central and in alignment with the spindles, thus eliminating side thrust on the spindle head and column ways, a feature of construction that reduces wear on the column ways and tends to increase the accuracy of the work.

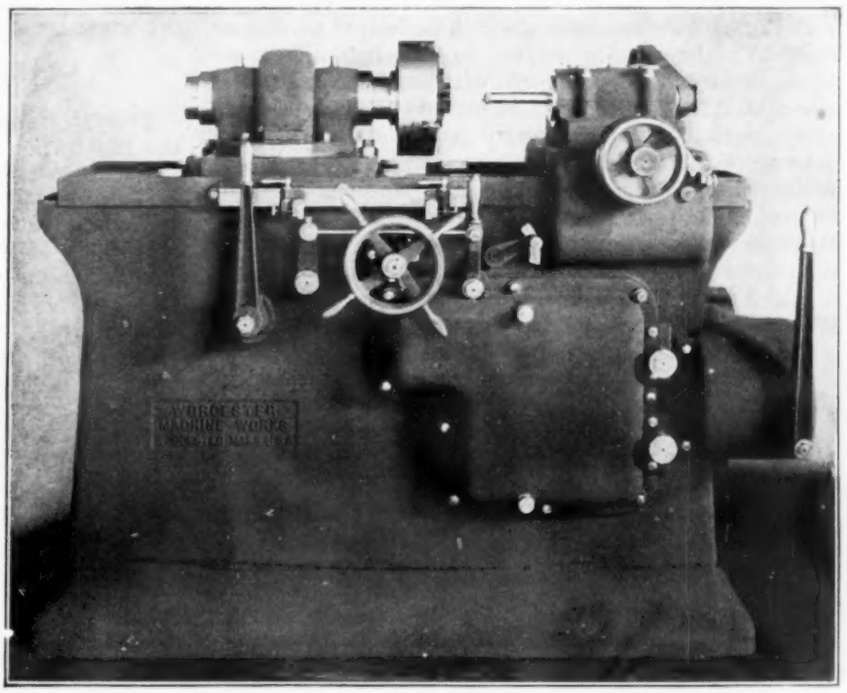
The spindle head is a casting of box construction, and is gibbed to the column by a square-lock method. The head supports the spindles and retains the spindle drive

gears. Each spindle, when arranged to be adjusted, either universally or in a straight line, is connected to the drive gears by a telescopic shaft fitted with universal joints. When arranged on fixed centers, the spindles are connected with the drive gears in a more direct manner without universal joints. Universally adjustable spindles are supported by brackets, which are fastened in two T-slots to a plain flange located at the lower end of the spindle head, while straight-line adjustable spindles are supported by L-shaped brackets fastened to a cross-rail. Thrust on all spindles is carried by SKF ball bearings.

The table and column are of cast iron, the table being furnished in either the knee or box type, as desired. The knee type is gibbed to the column by the square-lock method, and adjusted vertically by means of a crank operating a heavy jackscrew through a spiral-gear mechanism. The box-type table is made with a top surface provided with T-slots for clamping work. The bottom part of this table is fastened to a planed surface on the base, and is also provided with T-slots.

Lubrication is secured through a force-feed, gravity-flow and splash system combined, made possible by the all-inclosed unit construction. The combined feed and speed mechanism and the spindle heads are provided with independent and self-contained oiling systems, each of the units being tightly incased and immersed in a bath of oil, while the bearings are lubricated by a force feed through individual leads.

Extra attachments, such as hand feed for the spindle head, motor drive, holding fixtures and tools, and equipment for cutting compound, including pump, tank and piping fixtures, can be furnished, if desired.



WORCESTER TYPE A INTERNAL GRINDING MACHINE

Capacity, work up to 15 in. in diameter to be ground to any depth up to 10 in.; length of base, 59 in.; table, 51⅞ x 15¼ in.; distance from center of chuck to floor, 45 in.; front work-spindle bearing, 2⅞ x 5⅞ in.; rear work-spindle bearing, 2¼ x 6¼ in.; hole through spindle, 1¼ in.; speed for work, four, 61, 110, 195 and 278 r.p.m.; speeds for table travel, three, 17, 30 and 40 in. per minute; swivel of work head, 20 deg. each side of center; collet chuck, 7 in.; floor space, 40 x 80 in.; speed of countershaft, 600 r.p.m.

Worcester Type A Internal Grinding Machine

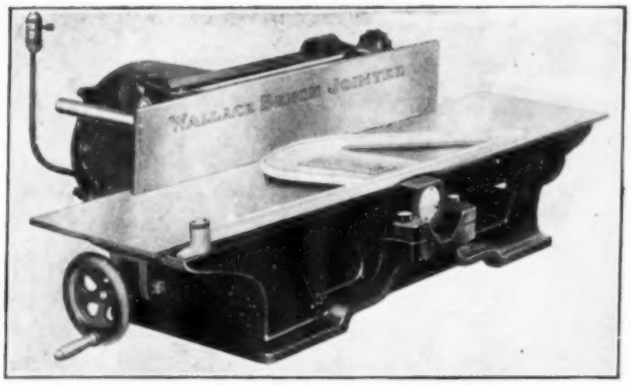
The Worcester Machine Works, Inc., 1109 Park Building, Worcester, Mass. has recently placed on the market the new internal grinding machine illustrated, which is known as the Worcester Type A. This machine is of the self-contained type, and the longitudinal motion is secured by mounting the work head on a sliding table, the crossfeed only being placed under the spindle head.

The base is of box construction and contains the work-head drum which is slow moving and balanced. This drum is mounted on ball bearings and suspended at a point in the base about 6 in. from the bottom, a feature that is said to reduce vibration. This drum is driven through the automatic box by a belt, the tension of which is maintained by a spring idler.

The automatic box which is located in the right end of the machine carries not only the reversing mechanism, but also the mechanism for changing speeds of both the table and the work head. The controls for these mechanisms are placed at the right side of the box, the upper dial controlling the table speeds, while the lower dial controls the speeds of the work head. Three table speeds and four head speeds are provided, and it is possible to make any change necessary while the machine is in motion. The vertical lever projecting from the top of the box controls the reversing clutch. The reversing mechanism is said to be designed to give the shortest possible stroke and to eliminate reversing troubles. An adjustment is provided to equalize the travel of the reversing cam. The change gears are of cast iron, bushed with hardened steel, with the exception of the two high-speed gears which are made of hardened steel throughout. The automatic box is driven by a friction clutch mounted in a pulley under the guards at the right end of the machine, the upright lever for the control of the clutch being within reach of the operator.

The work table is mounted on V- and flat-ways, the front way being of V shape, while that at the rear is flat. The table is driven through a pair of jaw clutches that are controlled by the reversing lever previously referred to. This lever is operated by stops on the front of the table when automatic action is desired, or may be controlled by hand. The work head is mounted on top of the table and is belted directly down in a straight line to the drum of the base, this method of driving insuring that the table is in proper contact with the base at all times. The work head swivels on the table 20 deg. each side of central position.

The long vertical lever at the left side of the machine lifts the drum clear of the work-head belt to enable the operator to move the table to any position while the machine is idle. This lever is so designed that by



WALLACE BENCH JOINTER

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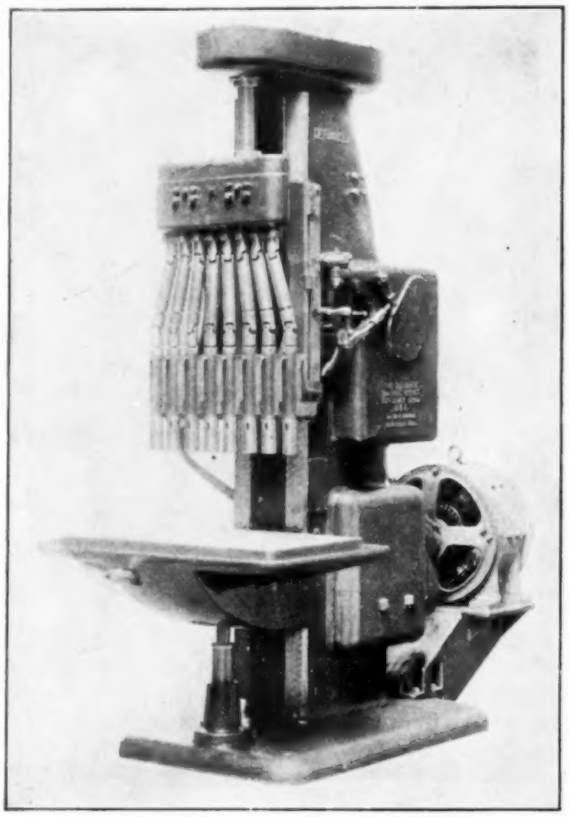
The No. 10 multiple-spindle drilling machine shown, a recent product of the Defiance Machine Works, Defiance, Ohio, can be equipped with a maximum of eight spindles with fixed centers, arranged in a straight line or cluster; or with a group of universally adjustable spindles arranged either in a straight line, a rectangular or a circular cluster. The machine is of the all-inclosed, unit-construction type; with a positive self-contained oiling system; automatic advance, feed and return of the spindles and is intended for production work.

The speed mechanism is located in the column near the base, and power is transmitted to a vertical drive shaft through gears. A friction clutch is used to engage the power and to select the proper back gear. The vertical drive shaft is fitted with a sleeve gear through which the spindles are driven, and this gear slides on the drive shaft with the spindle head as it is fed either up or down, this construction providing a drive closely coupled to the spindle head at any position on the column. Back gears are not furnished when the machine is arranged for a direct-connected, variable-speed motor.

The feed mechanism is housed in the column above the speed mechanism and consists of two friction clutches and a jaw clutch. The friction clutches are immersed in a bath of oil, and end thrusts are carried on SKF ball bearings. By engaging one of the friction clutches, the spindles are rapidly advanced until the drills come in contact with the work, at which point the jaw clutch is automatically engaged to feed the drills through the cut. When through the cut, the other friction clutch is automatically engaged, to effect a quick return of the spindles to the starting point. The levers operating these clutches are interlocking, preventing the possibility of more than one clutch being engaged at the same time. Feed changes are accomplished by removing the gear-case cover and changing two gears. The feed screw is operated from the feed mechanism through a vertical drive shaft and a train of spur gears. A bronze nut is used, and this is immersed in a bath of oil and located low in the spindle head to prevent the threads from being exposed when the head is fed to its lowest position on the column. The screw is located directly above the work,



DEFIANCE NO. 10. MULTIPLE-SPINDLE DRILLING MACHINE

Capacity, eight holes up to ⅞ in. diameter; minimum distance from center to center of spindles, 2 in.; maximum distance from center to center of spindles, 22 in.; vertical adjustment of collet in spindle, ¾ in.; diameter of spindle nose, 1¼ in.; Morse taper in spindle, No. 3; diameter of joints, 1⅞ in.; maximum distance from nose of spindle to base, 44 in.; minimum distance from nose of spindle to base, 30 in.; maximum distance from nose of spindle to table, 32 in.; vertical travel of spindle head, 14 in.; distance from center of spindle to column, 9.970 in.; vertical adjustment of table, 12 in.; working surface of table, 20 x 36 in.; back gear ratio, 1 to 2; spindle speeds, six, 110 to 344 r.p.m.; horsepower recommended to drive, 7½; floor space of belt-driven machine, 42 x 84 in.; weight of belt-driven machine, 5300 lb.; floor space of motor-driven machine, 42 x 96 in.; weight of motor-driven machine, 5700 lb.

causing the vertical feed thrust to be central and in alignment with the spindles, thus eliminating side thrust on the spindle head and column ways, a feature of construction that reduces wear on the column ways and tends to increase the accuracy of the work.

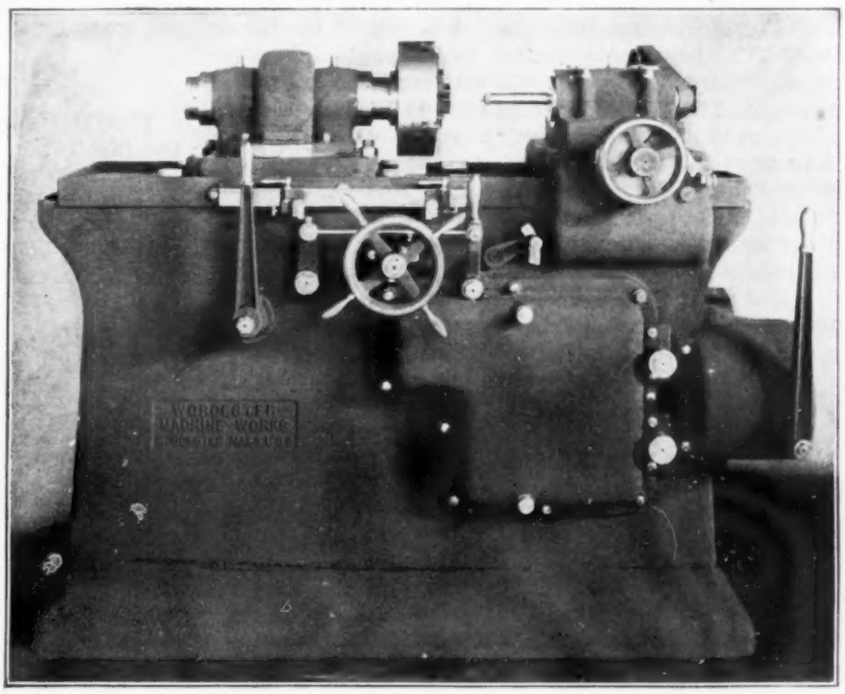
The spindle head is a casting of box construction, and is gibbed to the column by a square-lock method. The head supports the spindles and retains the spindle drive

gears. Each spindle, when arranged to be adjusted, either universally or in a straight line, is connected to the drive gears by a telescopic shaft fitted with universal joints. When arranged on fixed centers, the spindles are connected with the drive gears in a more direct manner without universal joints. Universally adjustable spindles are supported by brackets, which are fastened in two T-slots to a plain flange located at the lower end of the spindle head, while straight-line adjustable spindles are supported by L-shaped brackets fastened to a cross-rail. Thrust on all spindles is carried by SKF ball bearings.

The table and column are of cast iron, the table being furnished in either the knee or box type, as desired. The knee type is gibbed to the column by the square-lock method, and adjusted vertically by means of a crank operating a heavy jackscrew through a spiral-gear mechanism. The box-type table is made with a top surface provided with T-slots for clamping work. The bottom part of this table is fastened to a planed surface on the base, and is also provided with T-slots.

Lubrication is secured through a force-feed, gravity-flow and splash system combined, made possible by the all-inclosed unit construction. The combined feed and speed mechanism and the spindle heads are provided with independent and self-contained oiling systems, each of the units being tightly incased and immersed in a bath of oil, while the bearings are lubricated by a force feed through individual leads.

Extra attachments, such as hand feed for the spindle head, motor drive, holding fixtures and tools, and equipment for cutting compound, including pump, tank and piping fixtures, can be furnished, if desired.



WORCESTER TYPE A INTERNAL GRINDING MACHINE

Capacity, work up to 15 in. in diameter to be ground to any depth up to 10 in.; length of base, 59 in.; table, 51⅞ x 15¼ in.; distance from center of chuck to floor, 45 in.; front work-spindle bearing, 2⅞ x 5⅞ in.; rear work-spindle bearing, 2¼ x 6¼ in.; hole through spindle, 1¼ in.; speed for work, four, 61, 110, 195 and 278 r.p.m.; speeds for table travel, three, 17, 30 and 40 in. per minute; swivel of work head, 20 deg. each side of center; collet chuck, 7 in.; floor space, 40 x 80 in.; speed of countershaft, 600 r.p.m.

Worcester Type A Internal Grinding Machine

The Worcester Machine Works, Inc., 1109 Park Building, Worcester, Mass. has recently placed on the market the new internal grinding machine illustrated, which is known as the Worcester Type A. This machine is of the self-contained type, and the longitudinal motion is secured by mounting the work head on a sliding table, the crossfeed only being placed under the spindle head.

The base is of box construction and contains the work-head drum which is slow moving and balanced. This drum is mounted on ball bearings and suspended at a point in the base about 6 in. from the bottom, a feature that is said to reduce vibration. This drum is driven through the automatic box by a belt, the tension of which is maintained by a spring idler.

The automatic box which is located in the right end of the machine carries not only the reversing mechanism, but also the mechanism for changing speeds of both the table and the work head. The controls for these mechanisms are placed at the right side of the box, the upper dial controlling the table speeds, while the lower dial controls the speeds of the work head. Three table speeds and four head speeds are provided, and it is possible to make any change necessary while the machine is in motion. The vertical lever projecting from the top of the box controls the reversing clutch. The reversing mechanism is said to be designed to give the shortest possible stroke and to eliminate reversing troubles. An adjustment is provided to equalize the travel of the reversing cam. The change gears are of cast iron, bushed with hardened steel, with the exception of the two high-speed gears which are made of hardened steel throughout. The automatic box is driven by a friction clutch mounted in a pulley under the guards at the right end of the machine, the upright lever for the control of the clutch being within reach of the operator.

The work table is mounted on V- and flat-ways, the front way being of V shape, while that at the rear is flat. The table is driven through a pair of jaw clutches that are controlled by the reversing lever previously referred to. This lever is operated by stops on the front of the table when automatic action is desired, or may be controlled by hand. The work head is mounted on top of the table and is belted directly down in a straight line to the drum of the base, this method of driving insuring that the table is in proper contact with the base at all times. The work head swivels on the table 20 deg. each side of central position.

The long vertical lever at the left side of the machine lifts the drum clear of the work-head belt to enable the operator to move the table to any position while the machine is idle. This lever is so designed that by a

spring lock nut only can the drum be lifted and held free from the belt, an even tension being maintained on the belt while the drum is in normal position. The work spindle is mounted in phosphor-bronze bearings of the tapered adjustable style. The pulley between the bearings is guarded, it being possible to remove the guard in cases of necessity.

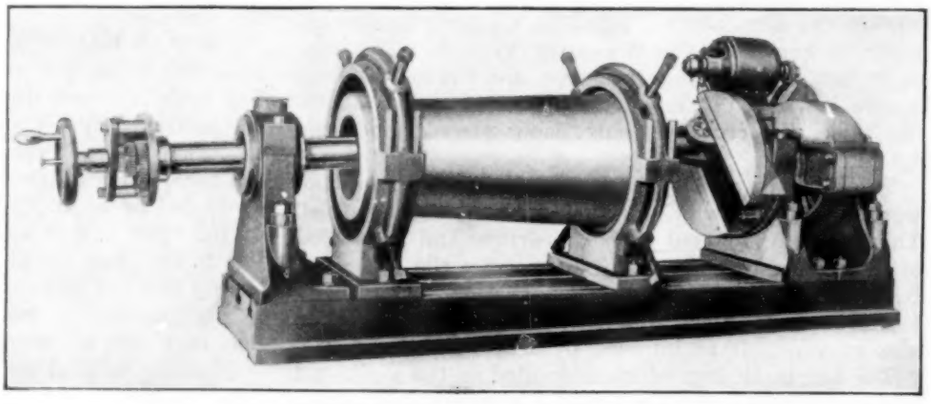
The wheel head is placed in a housing from which it can be quickly removed when it is desired to change sizes. The housing is secured to the cross-slide plate by dovetailed ways clamped with suitable gibs and screws, and this housing can be moved quickly in a crosswise direction, without using the cross-slide screw. The purpose of this construction is to give additional travel to the wheel head, necessary when grinding tapers of 20 deg., and also to aid the operator when two different diameters are to be ground at one time. The cross-slide plate is mounted on the bridge on dovetailed ways provided with gibs, the bridge being bolted to the base. The advantages claimed for this construction are that a solid massive foundation is obtained for the grinding spindle or wheel head that eliminates the vibration that might be caused by the rapidly moving grinding spindle.

The grinding spindle is driven through an endless belt 1½ in. wide, running from an idler pulley mounted on ball bearings. The pulley is carried by a bracket secured to the base by a sliding plate, and any vibration set up by the vertical driving belt is thus transmitted to the base and not to the wheel slide. The bracket is also hinged to the sliding plate and also connected by a spring link to the cross-slide, enabling it to travel with the cross-slide. The spring link between the idler bracket and cross-slide maintains an even tension on the wheel-head belt and the sliding pulley compensates for any variation in the length of the vertical drive belt.

At the right end of the machine is an oil pocket from which all bearings inside the base are oiled. The automatic box is oiled inside the cover, and suitable oil cups are placed on work head, wheel head and idler.

Pedrick Taper Boring Machine

The Pedrick Tool and Machine Co., 3640-3642 North Lawrence St., Philadelphia, Penn., has just placed on the market the taper boring machine, illustrated at work on a cylinder 30 in. long with a bore 9 in. in diameter at one end and 12 in. in diameter at the other. Larger machines of the same type can be built if desired. The machine consists essentially of three pedestals and two steadyrests mounted on a bedplate, the pedestals serving to support the boring bar and its driving mechanism, while the steadyrests hold the work in place. The bar is connected at one end with a heavy hinged joint to a sliding block in the faceplate, the degree of taper bored being determined by the amount the block is moved from the center of the faceplate. This arrangement allows plain cylindrical boring with the block placed central. The bar is supported in the pedestal at the left by a bearing that allows the necessary amount of oscillation. The boring bar is of the regular Pedrick type, the feed screw being imbedded in a groove on one side and causing the cutter head to travel along the bar. The feed gears on the end of the bar control the feed screw, giving a constant automatic movement to the cutter, this movement being variable for roughing and finishing. The machine can be furnished for either belt or motor drive, the one illustrated being of the latter type.

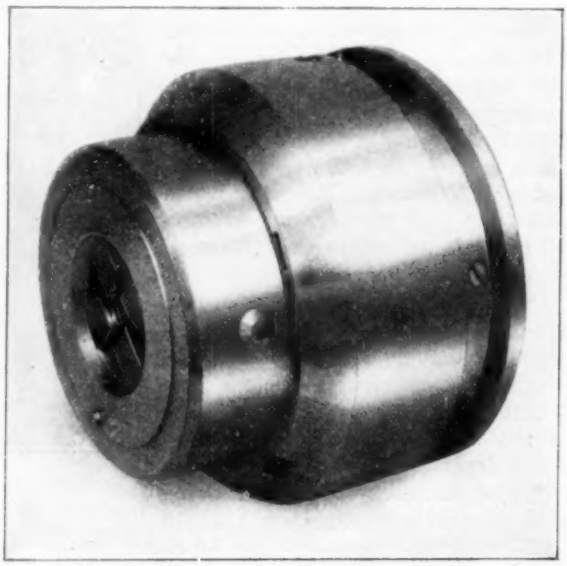


PEDRICK TAPER BORING MACHINE

Size of bedplate, 28 x 96 in.; boring bar, 3 in. in diameter; size of cylinder being bored, 30 in. long with 9-in. bore at one end and 12-in. bore at the other.

"Hartness" Automatic Die

The "Hartness" No. 4 Type R automatic die shown in the illustration is for use on automatic machines and bolt cutters where the tools revolve, and is a recent product of the Automatic Die Department of the Jones & Lamson Machine Co., Springfield, Vt. The device may be used on either horizontal or vertical spindles and has a sleeve for relocking which may be operated by a yoke or by engaging a fixed stop on a return stroke. The die is unlocked in the usual manner, by retarding its forward motion or by the external tripping button coming in contact with a fixed stop. This button may be seen projecting from the lower part of the front face of the die. It is stated that this feature is especially advantageous where it is desirable to cut short threads,



"HARTNESS" NO. 4 TYPE R AUTOMATIC DIE

as by its use parts have been threaded $\frac{1}{8}$—40 for a length of $\frac{1}{8}$ in. The diameter of the sleeve is $6\frac{3}{8}$ in. and the length of the die, as shown, is $5\frac{3}{16}$ in. It will cut threads from $\frac{1}{4}$ to $1\frac{1}{4}$ in. in diameter, either right or left-hand chasers being supplied as desired. No tools of any kind are necessary in changing chasers, which are the same as those used in the holder types of "Hartness" dies of same capacity. The dies can be supplied with shanks to meet requirements of users.

Fifield 96-Inch Engine Lathe

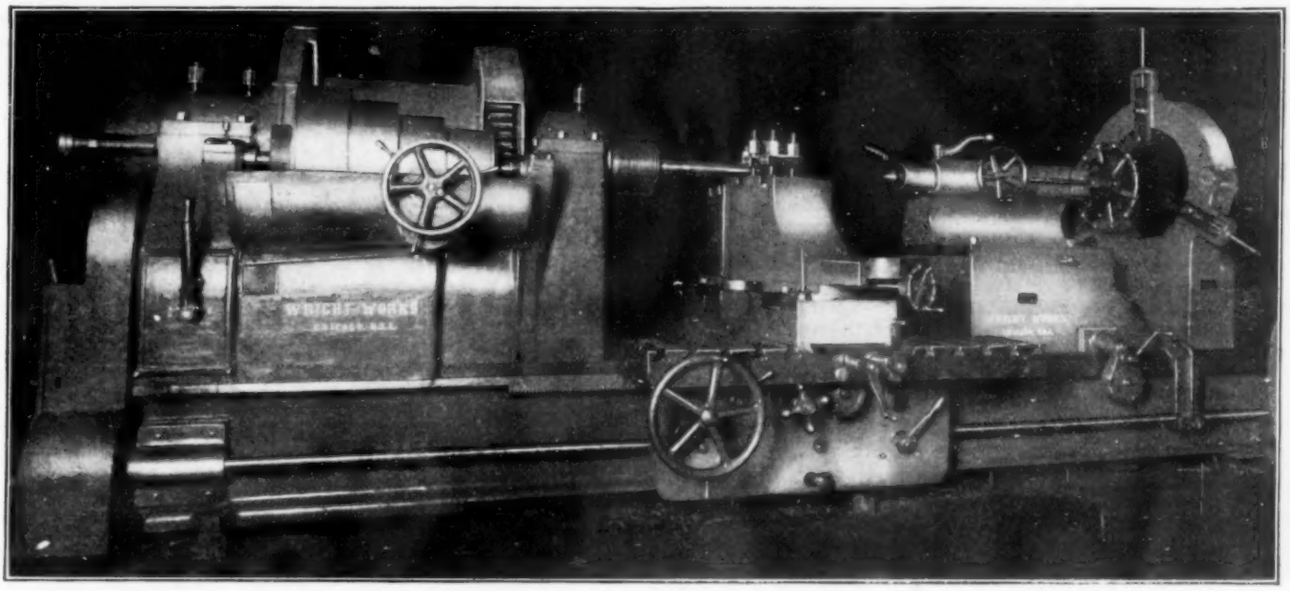
The Wright Works, 1150 South Washtenaw Ave., Chicago, Ill., has just placed on the market a 96-in., triple-geared lathe. The machine is cone driven from a back shaft, this construction being used in order to obtain sufficient power for the heavy cuts used. An 8-in. belt transmits 40 hp. to the spindle of the lathe. The spindle is of cast iron to reduce chattering and is of very generous proportions. The machine is triple geared and all gear changes are obtained through the handwheel located in front of the cone pulley, within easy reach of the operator. The handwheel is geared to a lever shaft, this construction reducing materially the effort necessary to shift the gears into the desired positions. Only one of the changes is through sliding gears, the balance being by means of clutches. The gearing and cone pulleys are so arranged that speeds are in geometric progression; 12 in number, ranging from 0.75 to 76 r.p.m. All gearing throughout the machine is made of steel, the pitch and width of face varying with the load. The triple gear that engages the faceplate internal gear is of one diametral pitch with a face width of 6 in. All shafts in the headstock run in phosphor-bronze bearings and are lubricated by sight feed oilers, placed in sight of the operator.

The feeds are also arranged in geometrical progression, and are obtained through a quick-change gear box which is integral with the headstock. The feeds are manipulated by the two levers shown at the front left end of the headstock—one behind the other—and give four feeds. Other feeds or thread-cutting feeds may be obtained by means of the regular feed change gears, which are located under the guard at the left end of the headstock. Twenty-four different threads may be cut with the gears furnished.

The carriage shown is equipped with two compound slides that may be fitted with power angular feeds if desired. The carriage bears on the ways for a length of 90 in. The lead screw is prevented from buckling by means of supports that are adjustable and placed about 10 ft. apart.

The tailstock is of box construction and is moved by hand by a geared drive engaging the teeth in the rack of the bed. The tailstock spindle is moved by a hand-wheel placed conveniently on the carriage near the front end of the tailstock. A massive steadyrest is also standard equipment.

The bed is ribbed throughout, is of box section, and is fitted with a rack down the center rib. A pawl on the tailstock engages this rack and removes the thrust of the cut from the clamps of the tailstock direct to the bed of the lathe. The bed of the machine illustrated is 48 ft. long and the total weight is 150,000 pounds.



FIFIELD 96-IN., TRIPLE-GEARED ENGINE LATHE

Width of driving belt, 8 in.; speed of countershaft, 200 r.p.m.; horsepower required, 40; front spindle bearing, 16 in. in diameter, 24 in. long; rear spindle bearing, 14 in. in diameter, 20 in. long; speeds, twelve, 0.75 to 76 r.p.m., feeds, four, arranged in geometrical progression, 0.025, 0.050, 0.100 and 0.200 in. per spindle revolution; length of carriage bearing on ways, 90 in.; length of bed, 48 ft.; distance between centers with 48-ft. bed, 34 ft.; weight, 150,000 lb.

About That Easily Made Sine Bar

BY W. C. LORING

It was of interest to me to note what J. B. Gray had to say on page 1097, Vol. 50, of *American Machinist* in reference to making a sine bar. He seems to have the right idea when he says that much more might well be said on this very interesting tool and he seems to grasp the idea that accuracy is one of its cardinal features, but how he can attain this accuracy by the use of a saucer wheel in grinding the surfaces of his sine bar and how he can possibly maintain the accuracy in the distance of the rolls even though he has set them with care, is something that the writer cannot understand and would like further enlightenment.

Sparks from the

Hardware Trade in the British West Indies

The colony of Trinidad and Tobago, in proportion to its population (371,876 on January 1, 1918), uses a great deal of imported hardware, and the United States supplies about three-fourths of all these imports. The proportion might be even further increased if American manufacturers would cater more to the trade in certain special lines, says Consul Henry Baker.

There is a special demand for oil-field supplies, sugar-factory equipment, and hardware of all kinds, including piping ¼ in. to 6 in., pumps, screw augers, iron stopcocks, bends, tees and elbows, globe valves, valve seats, asbestos millboard, asbestos coil packing, hydraulic packing, sledge hammers, riveting forges, white brass, half-and-half solder, cement, white lead, red lead, Babbitt metal, litharge, graphite, wrenches, drilling machines, swivel-jaw vises, stocks and dies for bolts, boiler-tube brushes, leather beltings, oil and steam gages and screwdrivers.

Dealers are eager to receive catalogs from the United States and are quick to introduce new articles for which a market seems to exist.

* * *

Penny Banks From Hand Grenades

The War Department had hundreds of thousands of hand grenades on hand or under order when the war ended. Outside of blowing a boche to atoms, there is very little conceivable use for a hand grenade. But one of Mr. Hare's assistants conceived the idea of removing the dangerous parts of the grenade, cutting a slit in them and putting them on the market as banks for children. Already sales of thousands of these little banks have been arranged for. If the hand grenades had been scrapped and sold only for the material in them, they would have brought on the average of 1c. each. But under the plan devised they bring about 24 or 25c. each.

* *

Monash Line of Valves Acquired by Harrison Boiler Works

The Monash line of pressure-reducing valves and pump governors, formerly manufactured and sold by the Monash-Younker Co., of New York and Chicago, has been acquired by the Harrison Safety Boiler Works, of Philadelphia. The purchase includes a stock of manufactured parts and valves, drawings, patterns, trade-mark and good will. The Harrison Safety Boiler Works will manufacture and market the valves under the trade name "Cochrane-Monash," and will supply repair parts for valves now in use.

Personals

L. A. CARTER, of the Moloney Electric Co., has reassociated himself with the Lehmann Machine Co., lathe builders, St. Louis, Mo., in the position of general manager and chief engineer.

HAROLD D. RICHARDS, formerly superintendent of materials with Gilbert & Barker Manufacturing Co., West Springfield, Mass., is now with the Walworth Manufacturing Co. as superintendent of materials at its Kewanee Works, Kewanee, Ill.

F. W. MCINTYRE, for the past 16 years connected with the Niles-Bement-Pond Co., Boston and Chicago, has been appointed sales manager of the Becker Milling Machine Co., Hyde Park, Boston, Mass. Mr. McIntyre took up his new duties on June 1.

LIEUT. WM. H. BECKWITH, of the U. S. Army, and formerly with Gilbert & Barker Manufacturing Co., West Springfield, Mass., is now foreman of the iron-valve department at the Kewanee Works of the Walworth Manufacturing Co., Kewanee, Ill.

GEORGE H. RICHEY has been appointed New England sales manager for the Sullivan Machinery Co., to succeed the late George E. Wolcott. Mr. Richey has been associated with Mr. Wolcott as sales engineer in New England and eastern Canada for several years.

L. K. GOSS has recently joined the sales force of the Tacony Steel Co., Philadelphia, Penn., and will act as assistant to Mr. Keefer, the Cleveland district sales manager. Mr. Goss was formerly connected with the sales force of Warner Swazey, Cleveland, Ohio.

E. G. BUCKWELL, secretary and manager of sales of the Cleveland Twist Drill Co., Cleveland, Ohio, recently sailed for Europe and will be gone for three or four months and will make investigations of trade conditions throughout England and the continent.

EDWIN T. JACKMAN, formerly of E. S. Jackman & Co., Chicago, has returned from Sheffield, England, where he has been investigating methods in connection with tool and alloy steels; and on July 1 will become manager of the Boston office of the Firth-Sterling Steel Co., McKeesport, Penn.

C. S. COLER has been appointed manager of the educational department of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn. This appointment was made possible by the resignation of C. R. Dooley, who has accepted a position with the Standard Oil Co. to promote educational work in that organization.

LIEUT. JOHN COOK, who was commissioned in November, 1917, and who was in charge of the inspection of fuses and adapters in the Chicago district, has returned to civil life and resumed his membership in the firm of George Cook & Sons, Patent Attorneys, 30 Church St., New York. He is a graduate of Stevens Institute of Technology.

A. H. CONQUEST, for the last two years employed as plant engineer and mechanical engineer of the Wright-Martin Aircraft Corporation, Long Island City, N. Y. and New Brunswick, N. J., has been appointed plant engineer at U. S. A. E. Plant, Long Island City, N. Y. Prior to this Mr. Conquest was general factory manager of the Kent Motors Co.

CAPT. FRANK R. MEADE, until recently in charge of the gage branch of the Inspection Division of the Ordnance Department, has resigned to accept the position of New York representative of the Wilton Tool Manufacturing Co., Boston, Mass. Captain Meade was formerly with the New Departure Manufacturing Co. and for a year and a half with the British Munitions Board in New York.

J. W. MCCABE, who until recently has been district manager of sales for the Chicago Pneumatic Tool Co., at Buffalo, N. Y., has been appointed special representative for the company's foreign-trade department and will shortly make an extended trip throughout the Orient, Philippine Islands and Australia. W. H. White has been appointed to take charge of the Buffalo territory during Mr. McCabe's absence.

I. W. NEEDHAM, of the Northern Steel and Hardware Co., Ltd., Manchester, England, is expected to arrive in America in a short time. Mr. Needham is interested in the buying and selling of all classes of engineering tools and motor specialties. He has for sale the American patent for a mechanical starter for motor cars. Anyone desiring to get in communication with Mr. Needham can do so by addressing him in care of the Hanover National Bank, New York City.

Government Sells Surplus Lumber

The director of sales of the War Department has just issued a statement to the effect that up to June 1 the Government had sold 53,000,000 ft. of its accumulated lumber surplus. The prices obtained ranged from $9 to $28 per thousand feet, depending upon the condition of the lumber and its location. Practically all kinds of lumber were included, but the greater portion consisted of spruce, pine, fir and hemlock.

World's Industrial Forge

By E.C.Porter
News Editor

Lyon to Hold Two Sample Fairs Annually

With the closing of the fair held in March of this year, the management of the Lyon (France) Sample Fair adopted a new policy and will hereafter hold two fairs annually, one in March, as heretofore, and one in October.

Preparations for the autumn fair are already under way. Ernest Perrin, 3 Park Row, New York, has been appointed official American representative of the fair, and all communications regarding it should be addressed to him. Entries for the autumn fair should be sent before July 31 and for the spring fair before Dec. 31; after these dates, the fair management announces, entries may be accepted but the position of the stalls in the various trade sections can not be guaranteed.

* * *

Trade Currents

CHICAGO

Increasing difficulty in securing deliveries in practically all lines of machine tools is the outstanding feature of the trade today. One manufacturer of automatic screw machines is unable to promise anything before January 1, and makers of gear cutters, boring mills and punch presses are in about the same situation. Buyers, who have accustomed themselves during the past six months to finding whatever they want on some dealer's floor and who have, therefore, bought only as they actually needed tools, will have to change their habits.

Trade continues on the same good basis, with perhaps the major portion consisting in sales to shoppers. No very large lists have been issued for bidding. The Stewart Warner Corporation and the Brunswick-Balke-Collender Co. are both doing considerable buying, but are picking up their various requirements as they are needed.

CLEVELAND

The machinery trade of northern Ohio is among the first industries to feel the effect of definite peace, and contrary to the usual development at the tail end of the month, a big spurt is seen in many branches of the business in Cleveland. The outstanding feature of the week is the closing of contracts by various concerns for machinery for export, showing an immediate revival of manufacturing activity in foreign countries, some of them directly affected by the war. The Cleveland Milling Machine Co., for example, has started shipment of milling machines and lathes to India, France and other foreign countries. These orders are believed to be the forerunners of much more big business of this character. The Warner & Swasey Co. has closed business for turret lathes with a big Java firm, which is expected to use the equipment in railroad building in the Far East.

This business, combined with a stream of orders for small equipment and individual large machines of various kinds, has put June ahead of May in the Cleveland market, and May was the best month of the year, according to leading interests. It is anticipated that July will not be as dull as usual in normal years, as indicated by the larger number of inquiries from local, domestic and foreign buyers. These inquiries are for machinery of every description.

So far as nearby territory is concerned, there is a surprising improvement in demand for equipment for general manufacturing purposes, against the large amount of business placed up to the present by the automobile interests of the Central West, which have been the principal consumers since the beginning of the year. Distributors and manufacturers here believe that this slowing up is due to the uncertainness of some motor-car interests as to their types for 1920 cars, and that as soon as these designs are decided upon they will be in the market again for still more equipment.

There is still some complaint heard here over the large amount of second-hand machinery that the manufacturers and distributors of new equipment have to compete against. This, however, is offset by the fact that new equipment now is realized by the purchaser to be as low as it is likely to get for a long time to come, if indeed it does not actually go higher, and this factor has stimulated inquiries for new equipment to a large extent during the last week or so.

* * *

Special Information Bureau Opened

In furtherance of its campaign for obtaining employment for discharged soldiers and sailors, the War Department has organized a Special Information Bureau to which ex-service men may apply for information on any point in which they are interested.

This Information Bureau is under the direction of Col. Arthur Woods, Assistant to the Secretary of War. Its function is to provide an agency to which ex-service men may apply directly on questions concerning allotments, war risk insurance, bonuses, employment, civil rights, vocational training and the like. The inquiries on these subjects, directed to Col. Arthur Woods, War Department, Washington, are forwarded to the proper bureau, where every effort is made to obtain prompt attention for them.

Business Items

The Becker Milling Machine Co. has appointed L. S. Devos, 24 Stone St., for the convenience of serving its export customers, as special representative in New York.

The Niles-Bement-Pond Co., Pittsburgh, Penn., has removed its office from the Frick Building to 425 Seventh Ave., where a complete stock of Pratt & Whitney small tools will be carried.

High Point Machine Works, Inc., Hign Point, N. C., has moved into larger quarters and has added a department for the sale of new and used steam and electric machinery and machine work.

The Cleveland Milling Machine Co., Cleveland, Ohio, announces that its new French agent is the J. Horstmann Co., and it will be under the personal direction of Henri Nourry, who is a member of the latter firm.

The Crawford Machine Tool Co., 21 Park Row, New York, has purchased the Bell Locomotive Works at Lincoln, N. J. It is reported that the new owners will remodel the plant and will manufacture machine tools.

W. L. Romaine Machinery Co. announces the opening of new headquarters at 157 West Water St., Milwaukee, Wis., where machine tools, pattern-shop equipment, electrical equipment, small tools, etc., will be carried in stock.

The Lanham Cotton Cultivator Co., Empire Building, Atlanta, Ga., is planning a factory for the manufacture of agricultural implements. It will need equipment for foundry, forge shop, machine shop, wood shop and paint shop.

The General Electric Co., by the acquisition of all the common stock of the Cooper Hewitt Electric Co., has secured control of the latter company. The company will be operated under the regulation and management of the General Electric Co.

E. Isbecque & Co.'s main office has been transferred from Antwerp to Brussells, Belgium, the latter having been its headquarters before the war. Mr. Isbecque and Mr. Todd are now located at the following address: Rue Otlet, Brussells, Belgium.

The Erie Crucible Steel Co., Erie, Penn., announces the appointment of the following agents: Metropolitan and Philadelphia district, Tidewater Steel Products Corporation, 149 Broadway, New York; Chicago, D. A. Bonitz, 1816 Fisher Building, Chicago, Ill.

The Bound Brook Oil-Less Bearings Co., Bound Brook, N. J., is having a new machine shop and office building built on Lincoln Blvd. It is of concrete and steel construction, 100 x 180 ft. and two stories high. This new building will adjoin the present foundry and the Nigrum Impregnated Wood Works.

The Central Steel Co., Massillon, Ohio, has opened a branch office in the Book Building, 35-57 Washington Blvd., Detroit, Mich. Arthur Schaeffer, formerly assistant director of sales at the home office, has been appointed district manager of sales with Frank Gibbons, who has recently joined the organization, as his assistant.

The Hart-Parr Co. has opened a branch office in Nashville, Tenn., known as the Tennessee Hart-Parr Co. for the sale of Hart-Parr tractors throughout the State of Tennessee. The manager in charge is Mr. Trousdale, formerly with the Burroughs Adding Machine Co. W. A. Ingalls is the Hart-Parr representative for the southern states.

Asher Golden, 311 West 59th St., New York, has been appointed by Compagnie d'Applications Mecaniques, of Paris, its exclusive agent in the United States, in connection with the sale of RBF thrust bearings, demountable bearings (Norma type), plain roller (heavy duty) bearings and thrust-bearings retainers complete with balls.

The New York Testing Laboratories which have been organized by L. R. Seidell, G. B. Jack, Jr. and H. H. Geist formerly chief metallurgist, assistant chief metallurgist and chief chemist respectively of the Wright-Martin Aircraft Corp., have in addition to their laboratories at 354 Mulberry St., Newark, N. J. opened up New York offices at 74-80 Washington St.

The Electric Furnace Co., Alliance, Ohio, has shipped one of its standard nose-tilting type furnaces to the United States Navy Yard at Washington, D. C., to be used in the Government brass foundry there. This furnace is provided with a motor-operated tilting mechanism and has a maximum hearth capacity of 2000 lb. The shell is 7 ft. in diameter, and the furnace is rated at 105 kw. in. electrical capacity.

The entire pumping-machinery business of the Canton Hughes Pump Co., Wooster, Ohio, has been purchased by the Chalmers Pump and Manufacturing Co., Lima, Ohio, which company is a reorganization of the Chalmers Manufacturing Co. The officers of the Chalmers Pump and Manufacturing Co. are C. S. Brown, president; Frank D. Shumato, vice president and sales manager; Fred. Biszantz, secretary and treasurer.

The Federal Machine and Welder Co., with main offices and factory at Warren, Ohio, has established offices at Cleveland, Ohio, in the Garfield Bank Building, Euclid Ave., Rooms 401 and 402. Arthur B. Sonneborn and his assistant, Fred C. Wilder, will have charge of these offices. Mr. Wilder will devote his attention to the Ohio territory and Mr. Sonneborn will continue to give his attention to the Detroit office at 1516 Ford Building.

S. F. Bowser, Ltd., Toronto, Ont., Can., has recently been re-organized to operate as a strictly Canadian organization, financed and managed under Canadian control. H. C. Christie, for several years connected with the Canadian factory, has been appointed manager, with E. E. Cummings as factory manager. The other officers are: S. F. Bowser, president; S. B. Bechtel, vice president; H. J. Grosvenor, secretary, and W. G. Zahrt, treasurer.

O. K. Piquet of the firm of Trajamo & Mederios, Rio de Janeiro, Brazil, manufacturers and distributors of heavy equipment for railroads, is in the United States for the purpose of studying farm tractors. He has been a guest of the Hart-Parr Co., Charles City, Iowa, for several days. Mr. Piquet's firm is establishing eight experimental farms in Brazil ranging in size from 2000 to 8000 acres and will demand power machinery in their operation.

The Badger Tool Co., Beloit, Wis., has recently been incorporated for the purpose of manufacturing and selling modern disk-grinding machinery and equipment. Its capitalization is $75,000. The officers of the new company are as follows: E. B. Gardner, president; C. E. Cadman, vice president; H. I. Kelley, secretary, and R. D. Gardner, treasurer. E. B. Gardner was formerly secretary of the Gardner Machine Co., Beloit, Wis.; R. D. Gardner formerly advertising manager, and C. E. Cadman and H. I. Kelley held the respective positions of chief draftsman and auditor for the same company.

Obituary

PAUL M. EINERT, 56 years old, died suddenly on June 5 at his home, 220 West 98th St., New York. M. Einert entered the accounting department of the Westinghouse Electric and Manufacturing Co. at East Pittsburgh in 1900. In 1910 he was appointed foreign auditor, with headquarters in London. After the purchase of the controlling interest in the French and Italian companies by the British Westinghouse Co. from the Westinghouse Electric and Manufacturing Co., Mr. Einert returned to service with the British company as their traveling auditor, holding that position until 1916, when he returned to this country as assistant to the comptroller of the Westinghouse Co. at Pittsburgh, Penn. In January of this year he was appointed special representative to the chairman, with offices in New York, his duties being in connection with foreign trade, in which capacity he served until his death.

Exports Show Decrease in May and Imports Show Increase

Exports for May totaled $606,000,000, a falling off of $108,000,000 from the record set in April, but an increase of $55,000,000 over May, 1918, according to a statement issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce. For 11 months ended with May the export trade amounted to $6,308,000,000, an increase of $872,000,000 over the corresponding period of the previous year.

May imports were the largest in the history of the country's foreign trade—$329,000,000, a gain of $56,000,000 over April, and of $6,000,000 over May, 1918, which was the previous high mark. Imports for the 11 months ended with May were valued at $2,803,000,000, an increase of $118,000,000 over a similar period in 1918.

The excess of exports over imports during the 11 months was $3,505,000,000, as compared with $2,751,000,000 for the corresponding period in 1918, and $3,364,000,000 in 1917, the previous record.

* * *

X-Ray Tests for Metal Castings to Disclose Defects

The use of X-rays for disclosing defects in materials like steel and timber was discussed at a recent meeting of the Faraday and Röntgen Societies, presided over by Sir Robert Hadfield, who some time ago initiated experiments in radiometallography at the research laboratory of his firm at Sheffield, England. It is claimed that one obvious application of the X-rays is to the examination of metal castings for defects, such as blowholes, which cannot be revealed by external inspection and yet may seriously impair the strength of the finished article. If the castings are not too large, each of them may be subjected to routine testing by the rays and blowholes occurring at regular intervals eliminated. The rays may also be employed to study the effect of adding different quantities of aluminum to steel, and thus ascertain the proportions needed for sound castings. Rough analysis of different steels is also feasible.

Mr. Schneider, at whose plant much work in radiometallography has been carried out, suggested that if a number of carbon-steel and tungsten-steel bars had been accidentally mixed up they might be quickly sorted by means of X-rays, the radiographs obtained with carbon being blacker than with tungsten steel, because the rays penetrate the latter less freely than the former, owing to the lighter atomic weight of the constituent tungsten. At present only a few inches can be penetrated, but great improvements have been made by the Coolidge X-ray tube, and further advances may be looked for not only in this portion of the apparatus, but also in the methods employed for detecting the rays after they pass through the material under investigation.

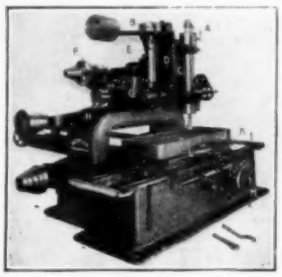
Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Grinding Machine, Radius-Link

Newton Machine Tools Works, Inc., 23d and Vine Sts., Philadelphia, Penn.

"American Machinist," June 12, 1919



For grinding radius links in connection with railroad equipment. The vertical spindle revolves in an eccentric sleeve which allows for a ½-in. movement front and back. This eliminates the necessity of moving the heavy table and allows for finishing a link without changing the position of the table. Thus, after the machine is set up with a fixed radius center, the adjustment made possible by the front and back movement of the spindle in the eccentric sleeve eliminates the necessity of changing the position of this center when a deeper cut is desired. Capacity of grinding, radii from 24 to 100 in. with thickness of the work up to 5 in.; can also be used for straight links with a maximum travel of 40 in.; adjustment of spindle, front and back, ½ in.

Grinding Machine, End-Surface

C. L. Hawes, 12 Adams St., Ashtabula, Ohio

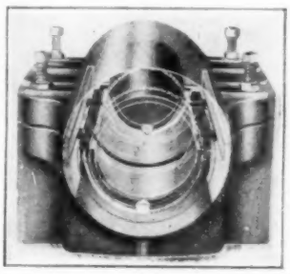
"American Machinist," June 12, 1919

The machine will grind the end surfaces of parts from 3 to 12 in. in length, stops being supplied to set any desired length. The wheels are the cup type, and the bearings are of the Timken roller type. In operation the wheels are moved apart by a foot pedal, the work being placed in a jig between the wheels. When the operator releases the pedal, the wheels close automatically, the jig in the center being moved mechanically across the face of the wheels. The machine is so arranged that either wheel can be adjusted independently of the other. Capacity, work from 3 to 12 in. in length; wheels used, cup type with 6-in. face, 18 in. in diameter with 3-in. face on cup side of wheel; electric motors, 5 hp., 1000 r.p.m., 60-cycle, a.c.; length of machine, 9 ft.; weight, 2750 lb.

Bearing Wipers

Industrial Products Co., 1024 Penobscot Bldg., Detroit, Mich.

"American Machinist," June 12, 1919

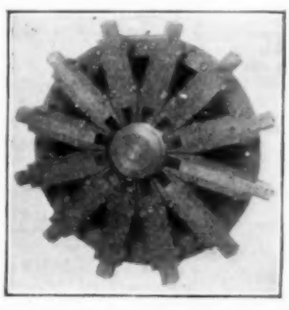


Consists of a tempered-steel spring with a triangular-shaped piece of babbit metal mounted on one end. This piece of babbit metal is shaped to the shaft, and is said to wipe it clean, returning the oil to the reservoir of the bearing. The spring is fastened to a convenient point in the groove at the end of the bearing or to the housing, there being a wiper at each end of the bearing. The wipers may be applied to plain, roller or ball bearings. It is said that they will hug the shaft under all conditions, and that they will last as long as the bearing itself. The shaft may be run in either direction, as desired.

Chucks, Pneumatic

American Pneumatic Chuck Co., Manufacturers; Neidow & Payson Co., 9 South Clinton St., Chicago, Ill. Sales Agents

"American Machinist," June 12, 1919

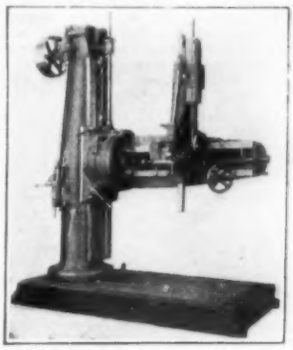


The illustration shows a special 12-jaw pneumatic chuck that will take work 28 to 36 in. in diameter, the jaws having a movement of something over 4 in. each. The chuck is only 3½ in. wide on the outside diameter, and the large number of jaws are used in order to prevent springing the work out of round. The chuck is shown with the faceplate off, giving some idea of the construction. The sliding jaws are moved from the air piston through a rack-and-pinion mechanism. The chuck is operated by a 12-in. standard double-acting cylinder and can also be made for external gripping by using false jaws. Special chucks of any style desired can be made.

Drilling Machine, Universal Radial

Western Machine Tool Works, Holland, Mich.

"American Machinist," June 12, 1919

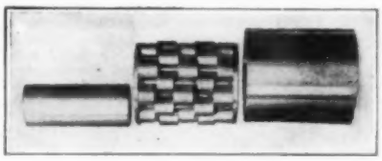


Made in three sizes, 4, 5 and 6 ft. Specifications for 5-ft. machine: Maximum distance from face of column to center of spindle, 61 in.; minimum distance from face of column to center of spindle, 26 in.; maximum distance from end of spindle to bed, 66 in.; size of working surface of base, 64 x 44 in.; number of speeds, sixteen, 16 to 230 r.p.m.; speed of driving pulley, 300 r.p.m.; number of drill feeds, four, 0.006 to 0.018 in. per spindle revolution; diameter of driving part of spindle, 2 15/16 in.; Morse taper in spindle, No. 5; traverse of spindle, 20 in.; net weight, 11,000 lb.; box table, 20 x 20 in.; horsepower of motor recommended, 7½; speed of constant-speed motor recommended, 1200 r.p.m.; variable-speed motor recommended, 400 to 1200 r.p.m.

Bearings, Roller

Hart Roller Bearing Co., 512 Main St., East Orange, N. J.

"American Machinist," June 12, 1919

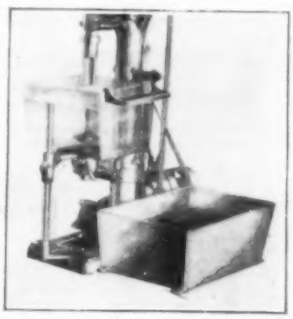


The rollers, instead of being made as long as the bearings, are made short and are mounted on alignment shafts supported at their ends by the retainer rings, the rollers revolving freely on these alignment shafts. The rollers are of different lengths and are staggered. The advantages claimed for this construction are that the bearing angle or the included angle between radial lines drawn from the axis of the bearing through the centers of the adjacent rollers is considerably reduced, that the staggered arrangement provides more space for the circulation of oil or grease, that frictional resistance between the cage and the rollers is reduced and that when one end of the bearing is loaded heavier than the other the staggered arrangement gives a greater load capacity than other arrangement. The rollers are made of a special analysis chrome-vanadium steel, heat-treated and ground to size.

Drilling Attachment, Submerged

Hjorth Lathe and Tool Co., 27 School St., Boston, Mass.

"American Machinist," June 12, 1919



The upper tank is attached to the drill table socket, and two centering holders, the lower of which is attached to the lower drill table, and the other to the bottom of the tank, allow it to be raised, lowered and kept in alignment. The drill is held in the holder which is fastened to the bottom of the tank, the point being covered by the cutting compound. The drill is self-centering in the socket holder. The tank is provided with an outlet, so that the lubricant can be be quickly drained. The drill holder accommodates drills from ¼ to 1½ in. in diameter. The work is held in a chuck attached to the drilling spindle, the drill remaining stationary. The advantages claimed are that the work is prevented from heating; that the drill is constantly lubricated, and hence of longer life and that the chips and shavings are kept from sticking.

Grinding Machines, Rotary Surface Nos. 20 and 22

Heald Machine Co., Worcester, Mass.

"American Machinist," June 19, 1919

These machines are made in two sizes, No. 20 with an 8-in. chuck and No. 22 with a 12-in. chuck. Specifications for 8-in. machine: Diameter of magnetic holding surface of standard chuck, 8 in.; face diameter of chuck, 9½ in.; grinding wheel, 10 in. in diameter with 1 in. face and 3½ hole; maximum distance between top of chuck and center of wheel, 8½ in.; maximum distance between top of chuck and face of 10-in. wheel, 3½ in.; minimum diameter grinding wheel used, 6½ in.; vertical adjustment of chuck, 5 in.; maximum swing inside of water pan, 13 in.; floor space for belt-drive machine, 48 x 60 in.

Patented Aug. 20, 1918

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

The purchase of pumps, motors and vending machines is desired by a firm in Portugal. Correspondence should be in Portuguese. References 29,574.

An agency and purchase of compressors, ventilators, finishing file-wheels (stone and iron), felt, cork, carborundum, alundum, machine tools and accessories, oil and tar furnaces, steel shafts, heavy crude iron spare pieces, machines to cut gears, and all tools for glassware and glass manufacturers are required by a firm in Belgium. Catalogs in French or English are requested. Correspondence may be in English. References. No. 29,601.

A firm in Belgium desires to purchase machinery for making jute, as follows: A steam engine, 500 hp.; oiling machines to make the jute supple; carding machines, breakers, spool machines, stretching machines, jute spinning mills for thick yarns (Nos. 5 to 10) and for thin yarns (Nos. 10 to 16); winding apparatus, rolls and cops machines, packing press, lifts for goods, heating and electrical lighting installation; all apparatus for forge; transmissions, iron and wooden pulleys, landings, greasing boxes, belts, sprinkles, weighing machines, etc. Payment, cash. Correspondence may be in English. References. No. 29,598.

A commercial agent in Belgium wishes to purchase and later secure an agency for the sale of insulated cables and wires for electric wiring, motors and dynamos for direct and alternating current, transformers and various electrical material. Correspondence should be in French or Flemish. References. No. 29,586.

A merchant in Belgium wishes to purchase and to secure an agency for the sale of machine tools, metallic cables, hemp cables, perforated sheet iron, chains, steel cylinders for rolling metals, metallic sheet iron, air filters, and all metallurgical products having a ready sale in that country. Correspondence should be in French. References. No. 29,502.

Trade Catalogs

Teenax Non-Shrinking Tool Steel. Edgar T. Ward's Sons Co., Boston, Mass. Catalog No. 2. Complete instructions for heat-treatment of "Teenax" non-shrinking tool steel, also tempering heats and colors for tool steels.

Patented Alloy Steel. Kinite Co., Milwaukee, Wis. A four-page descriptive folder of a new steel especially adapted for making cutters, dies, taps and other tools. Prices will be furnished upon application when accompanied with specifications giving weight, etc.

Crucible and Electric Furnace Steel. Simonds Manufacturing Co., Lockport, N. Y. Catalog, pp. 24, 4½ x 7 in. It shows the rapid development of American steel in the Simonds mill, also classifications and dimensions are given of high-speed steel and tables of decimals, gages and weights.

Lodge & Shipley Lathes. Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. Booklet, No. 196. A brief description showing the features of the Lodge & Shipley lathes.

Kreodon Wood Floors. Republic Creosoting Co., Indianapolis, Ind. Catalog, pp. 12, 8 x 11 in. Illustrating the service, economy and safety of the Kreodon floors in the large machine shops of the United States.

Machinery for Sheet Metals. Niagara Machine and Tool Works, Buffalo, N. Y. Catalog No. 54, pp. 112, 6 x 9 in. This fully describes how the company's machines can be modified in various ways, as to die space, drive, stroke and other details; also illustrating other types of machines for sheet-metal work. It will be sent upon request.

Inserted-Tooth Milling Cutters. Ingersoll Milling Machine Co., Rockford, Ill. Bulletin No. 38, pp. 39, 8 x 11 in., describing how it has specialized for 30 years in the design and construction of heavy milling machines, cutters and fixtures. It also gives specifications and illustrations of its various products.

Pryibil Woodworking Machinery. P. Pryibil Machine Co., Inc., 512-524 West 41st St., New York City. Catalog, No. 19, pp. 12, illustrated. This catalog covers all the details of the company's line of woodworking machinery, giving all dimensions, capacities, feeds, speeds, horsepower required, etc. It is announced that besides its regular line of woodworking machinery, the company manufactures spinning lathes, stud and bolt lathes, buffers and grinding machines and power transmitting machinery.

New Publications

Management and Men. By Meyer Bloomfield. Five hundred and ninety-one 5¼ x 8-in. pages, bound in red cloth boards, and published by the Century Co., New York. Price, $3.50.

The author of this book is a man who is often consulted on vital industrial problems by many wage earners and employers of large and important enterprises in the country. He organized the industrial service activities of the United States Shipping Board, Emergency Fleet Corporation.

In 1918 Mr. Bloomfield went abroad to report on new developments in the British labor fields. What British industry and labor are now doing is of the utmost practical interest to every American employer and workingman, to every thoughtful American citizen. The present volume is the result of that trip.

The book is a first-hand interpretation of big industrial happenings. The best minds in the labor and management field of Great Britain assisted. It presents in full the great documents which underlie the present industrial relations projects of British industry. For this reason the appendix has been made unusually large—the material in it serves as a practical manual of British joint industrial management.

American employers, students of industrial conditions, and all who follow the big developments in the world of labor relationships will find in this book material of interest.

The chapter headings are: From War to Work in Great Britain; More Output; Sidelights of Industry in Great Britain; Control of the Job; As the British Employer Sees It; How British Labor Sees It. The appendices are: Labor's Statement of the Housing Problem After the War; Report by Ministry of Reconstruction on Housing in England and Wales; Report by Ministry of Reconstruction on Raw Materials and Employment; The Employment Exchange from Within; Report of a Conference Between Organizers of Trade Unions, Bristol Employers and Others; Labor's Pronouncement on the Restoration of Trade Union Customs After the War; The Labor Party's Statement of the Labor Problems after the War; Industrial Reports; The Predecessor of the Whitely Scheme; National Council of the Pottery Industry; Trade Parliaments; Rules for Working the Hans Renold Shop Stewards' Committee; Workshop Committees; Labor Party Constitution; Index.

The Blind. By Harry Best. Seven hundred and sixty-three 5½ x 7¾-in. pages, bound in red cloth boards and published by the Macmillan Co., New York. Price, $4.

In this book the author takes up the subject of the blind, their condition and the work being done for them. The field has been entirely limited to the United States, except in so far as an account is necessary of the operations in foreign countries in the way of affording instruction to blind children and of devising a system of raised print, as an introduction to the work in this country. Other references to foreign work or publications are few. For those interested in this subject, the book contains an immense amount of statistics, comment and constructive suggestion. Since a large percentage of blindness comes from industrial causes, manufacturers, managers, superintendents and others will be interested as well as the specialist in this field.

The chapter headings are: General State of the Blind; Legal Treatment of the Blind; Economic Condition of the Blind; Popular Conceptions Regarding the Blind; Cost of Blindness; Causes of Blindness and Extent of Its Possible Prevention; Blindness and Hereditary; Blindness and Disease; Blindness and Accidents; Blindness as an Increasing or Decreasing Phenomenon; Organized Movements for the Prevention of Blindness; The Education of the Blind Prior to Its Introduction into the United States; History of the Education of the Blind in the United States; General Provisions in Respect to Institutions for the Blind; Day Schools for the Blind; Provision for the Higher Education of the Blind; Provision for the Education of the Blind by States; Constitutional Provisions for Schools for the Blind; Question of the Charity Connections of the Schools; Provisions Regarding Admission of Pupils into the Schools; Attendance of the Blind at the Schools; Forms of Instruction Given in the Schools; Cost to the State for the Education of the Blind; Public Donations of Land to Schools; Private Benefactions for Schools for the Blind; Use of Raised Print by the Blind; Publications in Raised Print for the Blind; Libraries for the Blind; Home Teaching for the Blind; Homes for the Blind—Homes for Adults; Homes for the Blind—Homes for Blind Children; Industrial Establishments for the Blind—Theoretical Aspects; History of the Workshop Movement in the United States; Organization and Results of Present Industrial Establishments; Possible Employment of the Blind in General Occupations; Present Extent of Employment of the Blind in General Occupations; Pensions for the Blind—Theoretical Considerations; Pensions for the Blind—In Practical Application; Indemnities Paid for the Loss of Sight—Through Suits at Law; Indemnities Paid for the Loss of Sight—Through Insurance Policies; Indemnities Paid for the Loss of Sight—Through Public Measures; Indemnities Paid for the Loss of Sight—Through Workingmen's Compensation Laws; Private Associations for the Blind; Public Commissions for the Blind; Provisions by the National Government for Persons Blinded in War; Conclusions with Respect to the Work for the Blind; Appendixes and Index.

Forthcoming Meetings

American Foundrymen's Association. Annual convention and exhibit will be held in Philadelphia the week of Sept. 29, 1919. C. E. Hoyt, secretary, 111 W. Monroe St., Chicago, Ill.

Boston Branch, National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. Donald H. C. Tullock, Jr., secretary. Room 41, 166 Devonshire St., Boston, Mass.

Electric Hoist Manufacturers' Association. Monthly meetings at the offices of the Yale & Towne Manufacturing Co., 9 East 40th St., New York City. Secretary, W. C. Briggs, Shepard Electric Crane and Hoist Co.

Engineers' Club of Philadelphia. Regular meeting the third Tuesday of the month, with the exception of July and August. Lewis H. Kenney is the chairman of committee on papers.

Engineers' Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

The International Railroad Master Blacksmith's Association will hold its annual convention in Chicago Aug. 19, 20 and 21. The location of the meeting in Chicago will be announced later.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn., Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Rochester Society of Technical Draftsmen. Monthly meeting, last Thursday. O. L. Angevine, Jr., secretary, 857 Genesee St., Rochester, N. Y.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting, third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meetings, first, second, third and fourth Mondays of each month, except July and August. Edgar S. Nethercut, secretary, 1735 Monadnock Block, Chicago, Ill.

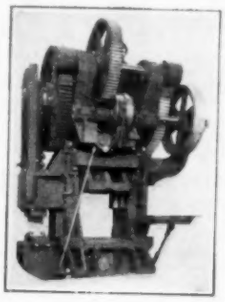
Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Press, Single-Crank Trimming

Toledo Machine and Tool Co., Toledo, Ohio

"American Machinist," June 19, 1919

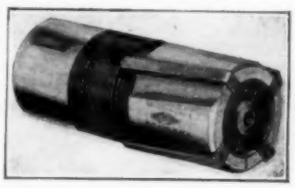


Believed to be the largest single-crank trimming press that has ever been built. The frame is of four-piece steel tie-rod construction, and consists of a base, two uprights and a crown held together by four steel tie bolts that are heated and shrunk into place, and serve to take the stress when the press is in operation. The outer shearing-off slide is operated by an eccentric shaft that extends through the bearing in an auxiliary housing secured to the outside housing by steel tie rods. The clutch is supported on a shaft, and held by a bracket bolted to the frame. This construction affords compactness and rigidity, and does away with the out-board bearing allowing a free space all around the press for access and the handling of material. Stroke, 16 in.; slide flange, 68 in. front to back, 40 in. from right to left; area of bed, 72 in. front to back, 48 in. from right to left; weight, 185,000 lb.

Reamers, Expanding

Wetmore Reamer Co., 210 Syracuse St., Milwaukee, Wis.

"American Machinist," June 19, 1919

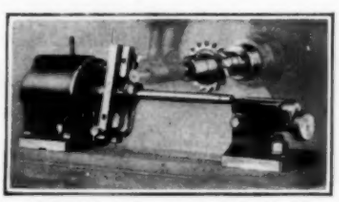


The feature of this new line of adjustable reamers is the left-hand, spiral cutting angle of the blades, which is stated to have been found particularly well adapted to work where speed and accuracy are required. By means of a wrench provided, a graduated screw collar that is counterbored in the front end of the reamer body may be manipulated to adjust the reamer to the proper size, each graduation on the screw collar indicating the change of 0.001 in. in diameter. No shims, screwdrivers, calipers or other tools are needed for adjustment. Blades are put up in sets of four or six, depending on the size of the reamer. The reamers are now made in diameters from 1 to 4½ in., four blades being used on sizes up to 3 in. and six blades on the sizes from 3 to 4½ in.

Indexer, "Brandt" No. 1

Meigs, Miller & Co., Inc., 129 Mill St., Rochester, N. Y.

"American Machinist," June 19, 1919



The features claimed are simplicity, speed of operation, compactness of design and the rapidity with which angular set-ups can be made with precision. It has positive stops for locating the work, a ball-thrust bearing on the spindle, and a line of fixed angle plates and taper tables. It is intended that a special index plate be used for each quantity job, each plate having only the required number of holes. Index plates are furnished up to 25 holes, spaced evenly or unevenly. The base fits a line of fixed angle plates, and by the use of these any single or combination angular setting can be secured. Swing on centers, 7 in.; table space required for headstock and tailstock, 4 x 4 in.; distance between centers on 36-in. slide, 24 in.; diameter of spindle, 25/32 in.; Morse taper in spindle, No. 3; weight of headstock, 14 lb.; weight of tailstock, 21 lb.; height in horizontal position, 5¾ in.; height in vertical position, 7¾ in.

Grinding Attachment, External

S. A. Potter Machine and Tool Works, 79 East 130th St., New York City.

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While primarily intended as an addition to the equipment of the Potter precision bench lathe, can be used on any lathe provided with a drum countershaft. Made to be used on the slide rest. The spindle runs on ball bearings, and is fitted with caps and felt washers to exclude dust. Adjustment is provided to compensate for wear. It will swing wheels from ¾ in. in diameter up.

Compressors, Air

Stratton & Bragg Co., Petersburg, Va.

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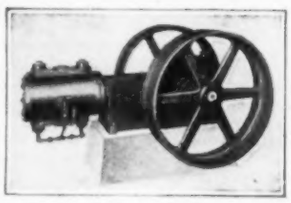
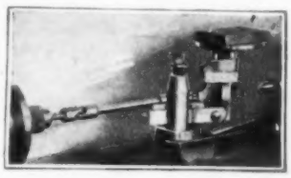


One of a line of air compressors recently placed on the market. The compressors are of the single-stage, straight-line center-crank, belt-driven type, moving parts being oiled by the splash system. The base of frame is a one-piece casting, to insure rigidity. The main bearings are lined with babbitt hammered and bored to size, and are adjustable. The crankshaft is made of a solid forging of openhearth steel. The cross head is of the box type with adjustable brass shoes to take up wear, and the connecting-rod is of openhearth steel. The cylinder is of cast iron, both heads being water-cooled and equipped with automatic valves. An unloading valve is connected with the receiving tank, so that when the desired pressure is attained, this valve acts automatically, holding the intake valves open and relieving the compressor.

Filing Machine, Rotary Die

Boston Tool and Manufacturing Co., Inc., 262-280 Dover St., Boston, Mass.

"American Machinist," June 19, 1919

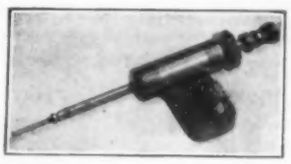


The device is designed to be held in the toolpost of the lathe, or fastened to the table of the drill press, the power being transmitted to the file through a shaft with universal joints. The files can be run at high speed, and needle points can be used as well as larger ones. The table is generally set so that the file just comes through the work and as the chips are drawn down by the motion of the file, the layout is clear and in plain view at all times. Another advantage is that there is no overhead mechanism, and a magnifying glass can be used to advantage. Capacity, files and cutters from pin point to ⅜ in. in diameter; thickness of dies finished, up to 1½ in; working surface of table, 5 to 8 in. in diameter; height from bench over all, 7 in.; chuck, for files or cutters with ¼-in. shanks.

Grinding Attachment, Internal

S. A. Potter Machine and Toolworks, 79 East 130th St., New York City.

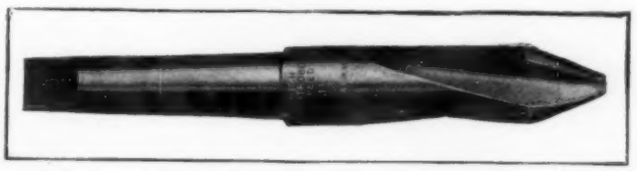
"American Machinist," June 19, 1919



While intended especially for use on the Potter precision bench lathe, this attachment may be used on other machines. It has an independently sliding spindle with a movement of about 4 in. All wearing parts are of tool steel, hardened and ground. The outer shell forms the bearing for a steel sleeve extending through it, having a tapered journal at the front end, and adjusting locknuts at both ends. The driving pulley is permanently attached to this sleeve at the rear end. The wheel spindle slides through the bearing sleeve and is splined to it. On the outer end of the spindle there is a loose wooden knob by which the operator may move the spindle back and forth while grinding. A taper hole in the work end of the spindle permits the use of arbors of various sizes to suit the work in hand, and any size hole from $\frac{5}{16}$ in. up to the capacity of the lathe may be ground.

Drills, High-Speed Countersink

Latrobe Tool Co., Latrobe, Penn.



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A line of high-speed steel countersink drills with either three or four flutes. The body of the countersink is made of high-speed steel, and is screwed and solidly brazed into the taper tool-steel shank with the patented Latrobe connection. In this connection the body of the tool is made with a taper-threaded shoulder, and this is screwed and brazed in a taper hole in the shank. The countersinks are made in various sizes, and with points of 15, 37, 45 and 60 degrees.

The Weekly Price Guide of

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co., as per Department of Commerce Committee Schedule.

CINCINNATI	
No. 2 Southern	$29.80
Northern Basic	27.55
Southern Ohio No. 2	28.55
NEW YORK—TIDEWATER DELIVERY	
Penna. 2X	31.90
Virginia No. 2	31.15
Southern No. 2	33.95
BIRMINGHAM	
No. 2 Foundry	25.75
PHILADELPHIA	
Eastern Pennsylvania No. 2	30.65
Virginia No. 2	30.85
Basic	30.90
Grey Forge	30.90
Bessemer	31.85
CHICAGO	
No. 2 Foundry local	27.25
No. 2 Foundry, Southern	31.75
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY	
No. 2 Foundry	28.15
Basic	27.15
Bessemer	29.35

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.47	$4.07	$4.20	$3.37	$4.20	$3.47	$4.20
Soft steel bars	3.37	3.97	4.10	3.27	4.20	3.37	4.10
Soft steel bar shapes	3.37	3.97	4.10	3.27	4.20	3.37	4.10
Soft steel bands	4.07	4.57	....	....	....	....	....
Plates, ¼ to 1 in. thick	3.67	4.27	4.45	3.57	4.20	3.67	4.45

*For ⅜-in. plates the extra is 30c. per 100 15.
Note—For less than carload lots add 4½c. per 100 lb.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Pittsburgh, mill, Eastern shipment	$2.35	$3.50
Warehouse, New York	3.37	4.70
Warehouse, Cleveland	3.22	4.10
Warehouse, Chicago	3.37	4.10

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	Pittsburgh, Mill, in Carloads	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Near Ago	Chicago Current	Chicago One Year Ago
*No. 28 black	4.35	5.37	5.62	6.45	5.27	6.385	5.37	6.45
*No. 26 black	4.25	5.27	5.52	6.35	5.17	6.285	5.27	6.35
*Nos. 22 and 24 black	4.20	5.22	5.47	6.30	5.12	6.235	5.22	6.30
Nos. 18 and 20 black	4.15	5.17	5.42	6.25	5.07	6.185	5.17	6.25
No. 16 blue annealed	3.75	4.77	4.77	5.65	4.67	5.585	4.77	5.65
No. 14 blue annealed	3.65	4.67	4.67	5.55	4.57	5.485	4.67	5.55
No. 10 blue annealed	3.55	4.57	4.57	5.45	4.47	5.385	4.57	5.45
*No. 28 galvanized	5.70	6.50	7.42	7.70	6.62	7.635	6.72	7.70
*No. 26 galvanized	5.40	6.20	7.12	7.40	6.32	7.335	6.42	7.40
No. 24 galvanized	5.25	6.05	6.97	7.25	6.17	7.185	6.27	7.25

* For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gage; for galvanized corrugated sheets add 15c.; all gages.

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List	List plus 10%
Cleveland	5% off	List plus 10%
Chicago	2% off	List plus 10%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	45%	40%
Cleveland	35%	35%
Chicago	35%	35%

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$25.50–30	$15.00
Cleveland	20.00	15.00
Chicago	16.50	15.00

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
½, 11, 5/16, ¼, 7/32, 3/16, No. 8, 7/32 and No. 10	25.50 to 33.00	⅜ by 12 in. long	14.00
No. 12		⅜ by 19 in. long	12.00
5/32, No. 14 and 1/16		½ by 19 in. long	10.00
No. 18		½ by 21 in. long	10.00
No. 20		Special Welding Wire, Coated	
		⅛	33.00
		5/32	30.00
		3/16	38.00

Domestic 20c. for 1/16, 15c. for ⅛ to 5/16.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	8.00
Spring steel (light)	10.00	11.25	11.75
Coppered bessemer rods	8.00	8.00	7.07
Hoop steel	4.07	4.75	4.07
Cold-rolled strip steel	7.50	8.25	8.10
Floor plates	5.67	6.00	5.92

Note—For less than carload lots add 4½c. per 100 lb.

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh: basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's Co. for iron, both dated Mar. 21, 1919.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
⅛, ¼ and ⅜	50½%	24%	¾ to 1¼	39½%	23½%
½	54½%	40%			
¾ to 3	57½%	44%			

LAP WELD

2	50½%	35%	2	32½%	18½%
2½ to 6	53½%	41%	2½ to 6	34½%	21½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛, ¼ and ⅜	46½%	29%	¾ to 1¼	39½%	24½%
½	51½%	39%			
¾ to 1¼	55½%	43%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	48½%	37%	2	33½%	20½%
2½ to 4	51½%	40%	2½ to 4	35½%	23½%
4½ to 6	50½%	39%	4½ to 6	34½%	22½%

Stock discounts in cities named are as follows:

	New York Black	New York Galvanized	Cleveland Black	Cleveland Galvanized	Chicago Black	Chicago Galvanized
¼ to 3 in. steel butt welded	47%	31%	46½%	31%	57½%	44%
3½ to 6 in. steel lap welded	42%	27%	42½%	27½%	53½%	41%

Malleable fittings. Class B and C, from New York stock sell at list +12½%. Cast iron, standard sizes, 10% off.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	18.00	15.37½	23.50
Tin in 5-ton lots	72.50	72.50	91.00
Lead	5.35	5.25	7.25
Spelter	6.85	6.05	7.62½
ST. LOUIS			
Lead	5.10	5.00	7.12½
Spelter	6.50	6.20	7.31½

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Copper sheets, base	26.00	22.50	31.50–33	26.50	35.00	27.00	31.50
Copper wire (carload lots)	24.00	23.00–28	32.00	26.50	34.00	23.00	31.00
Brass sheets	20.50	23.75–28	30.75	25.00	30.00	21.50	30.00
Brass pipe	30.75	34.00–37	36.50	33.00	41.00	31.00	40.00
Solder (half and half) (case lots)	38.00	46.50–41	62.00	41.00	41.25	39.00	55.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; net extras:

	Current	One Year Ago
Mill	$18.00½	$25.25
New York	19.50	26.25
Cleveland	24.00	30.00
Chicago	24.00	28.00